

The Journal

OF THE

Ministry of Agriculture

JANUARY, 1922.

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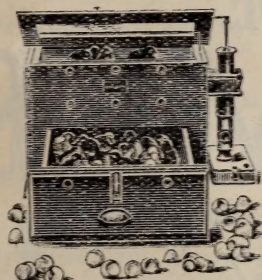
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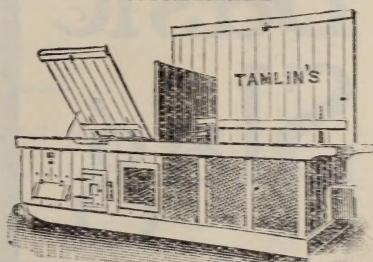
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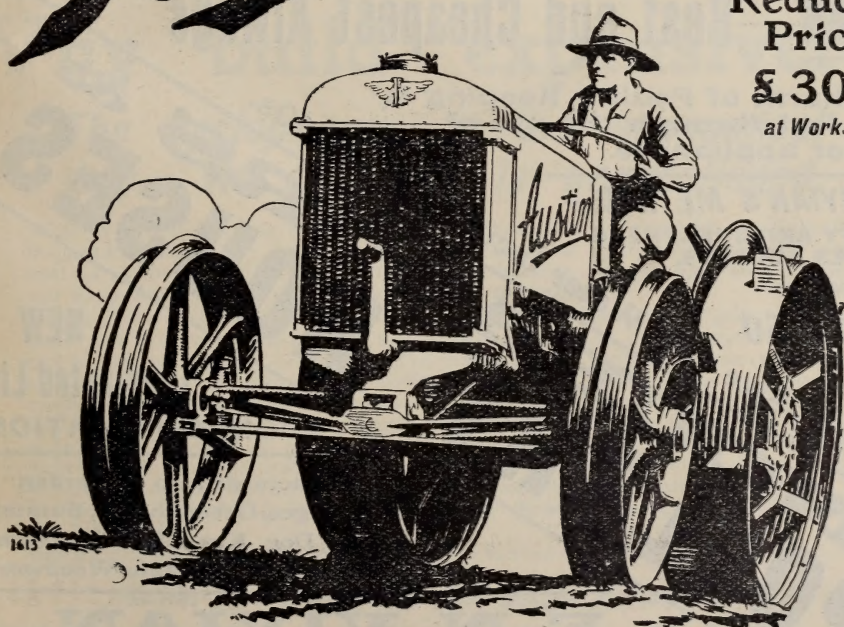
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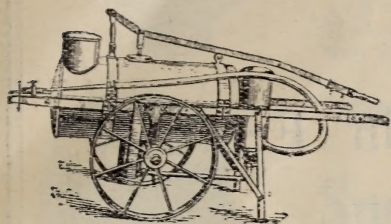
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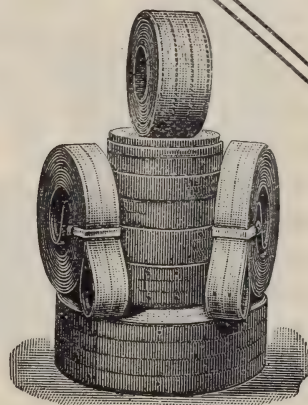


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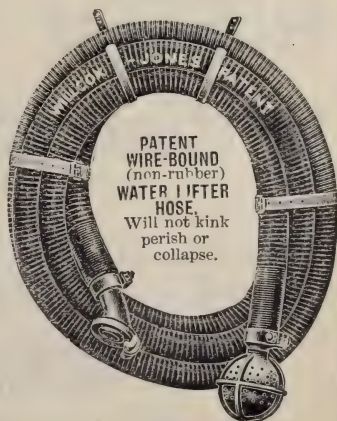


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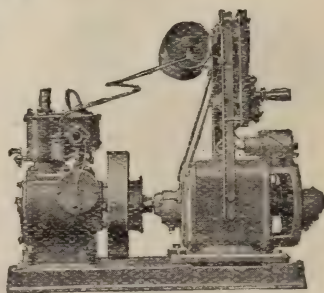
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THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXVIII. No. 10.

JANUARY, 1922.

NOTES FOR THE MONTH.

THE principle of collective bargaining in regard to agricultural wages which was introduced into the industry by the Corn Production Acts (Repeal) Act has now been tested in a large number of counties in England and Wales, and, although difficulties have been met with, progress on the whole has been more rapid than might have been expected. At a time like the present when the industry is experiencing an unprecedented fall in values, the conciliation machinery is of exceptional value, though the very fact that it is of value and is needed makes its use and application more difficult in practice.

The agreements which have been made up to now have in most instances been for short periods only, but as the industry tends to become more settled and the principle of the conciliation committees is better understood, agreements for longer terms will no doubt be reached, and the inconveniences arising from constant revision of rates will be removed.

Little use has been made during the past three months of the provision in the Act enabling agreements to be confirmed and thus made legally binding. Here again experience may show that there are substantial advantages in confirmation.

One provision in the Act which is for the moment practically a dead letter is the one enabling committees to elect an independent chairman, with or without power to vote. On the other hand many committees have invited a representative of the Ministry to attend their discussions and it has been found that the assistance and co-operation of an independent person not directly connected either with employers or employed is of the greatest value.

* * * * *

THE index number of the prices of agricultural produce, which is prepared each month by the Ministry, and is based upon the prices at representative markets published each week in the "Return of Market Prices" (now the "Agricultural Market Report"), shows that during November the general level of prices of agricultural produce in England and Wales was about 84 per cent. higher than in 1911-1913. The decline which has continued almost without interruption since November, 1920, was thus checked to some extent; the prices in the previous month were about 90 per cent. above those ruling in pre-war days, so that the fall indicated by the latest figures is only 6 points, compared with 15 points from September to October. The following table shows the figures for each month since the beginning of 1919:—

Month.	Increase per cent. on the average of the years 1911-1913.						
	1919.			1920.			1921.
January	148	...		213	...		186
February	150	...		205	...		172
March	150	...		199	...		158
April	153	...		199	...		141
May	132	...		169	...		112
June	128	...		164	...		102
July	141	...		174	...		100
August	138	...		177	...		116
September	148	...		181	...		105
October	166	...		191	...		90
November	182	...		197	...		84
December	207	...		194	...		—

Practically all classes of produce were concerned in the fall in November, the chief exceptions being eggs and milk. The average price of wheat during November was only 45s. per 480 lb. or less than 40 per cent. higher than in 1911-1913, while oats were also less than 40 per cent. dearer than in pre-war days. Fat stock of all descriptions declined considerably in price, although the decline was somewhat less marked than in the previous month. Dairy cows were rather dearer, but store stock showed little alteration in price compared with the previous month, but remained relatively cheaper than fat stock.

Feeding stuffs showed little change in price, milling offals and maize being slightly dearer and oilcakes experiencing a correspondingly slight decline. Fertilisers also were not greatly altered from the previous month, although superphosphate and nitrate of soda were inclined to be easier in value.

* * * * *

THE publication hitherto issued by the Statistical Branch of the Ministry under the title "Weekly Return of Market Prices" will in future be known as the **The Agricultural Market Report.** "Agricultural Market Report," and in addition to reports on markets and market prices in England and Wales, will contain information on the export trade in agricultural products from foreign countries and the colonies to the United Kingdom, together with such information as can be obtained as to openings abroad for British farm products.

The desirability of publishing information of this character has been pressed upon the Ministry by the National Farmers' Union, and an endeavour will be made to include original items of information which are likely to be of direct value to the farmer.

The return has hitherto been supplied to the public free, but in view of the increased cost of printing and publishing, it has been decided that after 1st January, 1922, the "Agricultural Market Report" can be supplied only to subscribers. The rate of subscription will be 10s. per annum or 5s. for six months, post free. Single copies 2d. (or by post 3d.). Application should be made to the Secretary, Ministry of Agriculture and Fisheries, Publications Branch, 10, Whitehall Place, S.W.1, or to H.M. Stationery Office, Imperial House, Kingsway, W.C.2.

* * * * *

THE Ministry has arranged with the authorities of the University College, Reading, to hold a special course of instruction on Milk Recording, from 27th February to 18th March, 1922. Full particulars of the course are shown in the syllabus outlined below.

**University Course
in Milk
Recording.**

It is expected that the demand for qualified recorders for employment under the Ministry's milk recording scheme will increase as the scheme develops, and while the appointments of milk recorders—which are not made by the Ministry itself but by milk recording societies—carry with them somewhat limited salaries (usually from about £150 to £250 per annum), such appointments afford the young agriculturist excellent opportunities of gaining a practical knowledge of dairy farming as carried out on a variety of farms. It is impossible to give any indication as to the number of vacancies for milk recorders which may arise from time to time, nor can any guarantee be given

to students at the course that they will, in fact, obtain employment as milk recorders. The Ministry will, however, arrange to bring under the notice of all milk recording societies the names of successful students, with a view to preference being given by such societies to these students over other applicants when any vacancy for appointment arises.

Syllabus of the Course.—Students will travel to Reading on Monday, 27th February, and tuition will begin on the following day. Each day's instruction will include (a) at least two hours' theoretical teaching, and (b) practical work in weighing, sampling, testing, and the keeping of milk records.

(a) *Lecture Course.*

1. *Milk.*—Nature and composition; causes of variation; Food and Drugs Act; regulations concerning milk.

Bacteria.—Milk as a medium for bacteria; control of bacterial growth; importance of cleanliness; use of preservatives.

Testing.—Weighing; methods of sampling; simple and composite samples; determination of the percentage of fat, and of the specific gravity; the Gerber Test; the Lactometer, calculation of percentage of total solids from percentage of fat and specific gravity; calculation of averages.

2. The principles and practice of milk recording; the Ministry of Agriculture's scheme; why accuracy in detail is essential; discussion of the duties of recorders, with a study of the forms which must be kept; milk record certificates and register of dairy cows; interpretation of milk records; calculation of herd averages; marking of cows; calf and bull marking scheme; methods of keeping food records.

(b) *Practical Work.*

Actual milk recording; the taking of simple and composite samples under various conditions; determination of the percentage of fat (Gerber method) and the specific gravity; calculation of total solids; use of the Richmond scale; visits to farms, evening and morning, to weigh milk and make the necessary entries; checking records; detection of errors and abnormal results; keeping food records and calculating cost of feeding and cost of food per gallon of milk.

At the conclusion of the course the authorities of the University College, Reading, will notify in writing those students who have satisfied their instructors as to their industry and general ability, and who have passed both the theoretical and practical examination held during the closing days.

Tuition Fee and Residence.—The tuition fee for the course will be £3. Board and residence is obtainable in the neighbourhood of the college at rates varying from £1 15s. to £2 5s. per week, and a list of lodgings will be sent to inquirers on application to the Dean of the Faculty of Agriculture, University College, Reading, to whom applications for admittance to the course should be forwarded before 15th February, 1922.

THE NEED FOR LIME AND HOW TO MEET IT.—II.

B. H. BEDELL.

IN an article on this subject in the June issue of this *Journal*, the writer showed in what way the urgent need for more agricultural lime could be met by farmers who were so situated that they could utilise a portable limestone grinding plant. It is now proposed to describe, in the briefest outline, the principal features of larger and permanent limestone-grinding plants, and give some particulars of lime kiln construction, and the process of lime burning.

Permanent Agricultural Limestone Plants.—In cases in which the probable local demand for ground limestone warrants the installation of a fixed plant to be owned by a farmers' co-operative association, or by a company making a business of grinding limestone, it will always be necessary, except when chalk is being dealt with, to elaborate the plant more than was considered expedient in the case of the portable types described in the previous article, and to produce a more finely-ground product. To this end the stone must be broken down to about 1-inch cube before it is passed into the mill for fine grinding.

The lay-out of the plant will therefore be somewhat as follows:—

- (a) Receiving hopper and chute into which quarry skips tip the rough stone, delivering into—
- (b) Jaw breaker, reducing stone to $2\frac{1}{2}$ -in. cube.
- (c) Elevator, raising broken stone to—
- (d) Small breaker, or rolls discharging directly into feed hopper of—
- (e) Fine-grinding mill from which the stone dust is raised by an elevator into storage bins from which it can be loaded directly into wagons or bagged through properly constructed sacking mouths.

In the case of small plants, a second jaw breaker or rolls can frequently be omitted by setting the first breaker to produce material fine enough to feed directly into the fine-grinding mill.

With regard to (b) and (d) little need be said, since these are quite standard pieces of plant with which every quarry manager is familiar. The fine grinding, however, presents many problems, the answers to which are only now being worked out. There are, broadly speaking, three types of mill which in modern practice are considered in connection with this work.

First, there is the High-Speed Mill in which the stone is ground between steel surfaces somewhat after the principle of a pestle

and mortar. Such mills are represented by "The Griffin," "Bradley" and "Fuller Lehigh." In these, the stone is crushed, percussed and ground, while at the same time, the ground product is being constantly stirred up and thrown against a screen which determines the maximum size of a particle which can pass out of the mill. If an excessively fine product is not demanded, such mills offer a cheap and efficient means of reducing the stone, provided care is used in their selection and types which involve the use of bearings within the grinding chamber are avoided, since it is obviously difficult to exclude dust from them if they are running in the midst of it.

The second type is the Ball Mill, in which the stone is broken by percussion in a chamber in which there are a number of steel balls. The inside of the chamber is lined with steel plates set to form a series of steps upon which the balls fall as the chamber rotates. The outside is encircled by a wire screen. The ground product is continuously subjected to screening, so that only those particles which are still too large to go through the screen are retained in the mill for further reduction. This mill produces normally a product very similar to that obtained by the use of the first type described, but owing to the rather more rigorous screening, the proportion of "fines," that is, of material very much finer than the mesh of the screen used, is rather smaller than with the first type. This is not an advantage from the agricultural point of view.

The third type is known as the Short Tube Mill. It consists of a slowly-revolving steel drum, with a slightly inclined axis, in which originally pebbles were used as the grinding medium. The stone is fed in slowly at one end, and finds its way through the drum to the other end as the drum rotates, the rate of feed being adjusted so that by the time the stone reaches the far end of the machine, it is ground by attrition between the pebbles to the required state of subdivision.

The last few years have produced two modifications of this class of mill. In the first place, steel or chilled cast iron balls have, to a large extent, replaced pebbles, and in the second place, a direct air draught through the drum is frequently provided to bring about air separation of the finest dust as it is formed. In this way the output of a given mill can frequently be increased by 15 to 20 per cent. while scarcely interfering with the quality of the product. Unless the fine dust is removed in this way it continues to be dragged round until it finds its

way out with the bulk of the material, thus taking up valuable space which might be better occupied by stone particles still requiring reduction. Mills of this type can be employed when a very fine product is aimed at, such as would leave 5 per cent. residue on a 60 screen or finer.

A grinding plant to deliver 50 tons of ground stone a day, and consisting of machines similar to those described, would require approximately 100 h.p. to operate it, and the actual quarry and mill costs involved in producing the ground material should not amount to more than about 8s. per ton. To this must be added sums representing overhead charges, including interest on capital and maintenance of plant.

The qualities of stone suitable for agricultural purposes, the degree of fineness of grinding, the chemical composition, etc., have all been dealt with in the previous article, to which reference should be made. Following this brief sketch of the means available for increasing the supplies of ground limestone, an outline may now be given of the plant and processes used in preparing quicklime, devoting particular attention to kilns and methods most likely to be of service to agriculturists who recognise the necessity of cheap lime, and are prepared to take the necessary steps to burn it for themselves.

Lime Burning.—The very ancient craft of lime burning consists in heating any fairly pure limestone or chalk (CaCO_3) to a temperature high enough to drive off the carbonic acid gas (CO_2), which is combined with it, leaving behind the lime or calcium oxide (CaO). It is one of the very simplest of commercial chemical processes, but it is not, for all that, one which can be uniformly carried out without both theoretical knowledge and experience.

Before describing some of the types of kiln in which the burning is done, it will be well to look at the theoretical considerations which are involved. Carbon dioxide begins to be driven off from limestone at a temperature of about 600°C. , but it is necessary to raise the temperature to somewhere between 900°C. and $1,200^\circ \text{C.}$ in order to make sure that the burning is complete. Even so, it is necessary that the stone should remain at this temperature for an appreciable time, and not simply be hurried through the hottest part of the kiln. The effect of either too low a temperature, or a too rapid passage through the reaction zone (as that part of the kiln is called where the highest temperature is attained), is the production of lime in which there is a large amount of "core," composed of

the centre parts of the larger pieces of limestone which have not given up the whole of their carbon dioxide. Although it is necessary to raise the stone to a high temperature in order to complete the reaction, it is not always safe to reach the upper limit given, for too much heat opens the door to several different kinds of trouble. In the first place, a stone which contains any appreciable percentage of impurities, such as silica, alumina or iron, will be found partially to fuse and to combine with the impurities in such a way that it is very slow to slake, and, even if it will slake, may be very granular and insoluble. Moreover, even a pure calcium carbonate stone if over-burnt will yield a granular hydrate, which is much less satisfactory than the impalpable powder formed when water in the correct proportions is added to a well-burnt stone. It is an interesting fact that, owing to the combination between the magnesium and calcium carbonates in a dolomite breaking up below the temperature at which the carbon dioxide is given off, the resulting hydrate is often of the very finest grain, provided of course, that the dolomite is free from fusible impurities.

Amount of Heat required.—Despite the claims of phenomenal efficiency put forward by the proprietors of special types of kiln, there is a certain minimum amount of heat which must necessarily be supplied to burn a given weight of lime, and below this minimum it is utterly impossible to go, no matter how wonderfully efficient the special kiln recommended may be. In the first place, there is the heat required to drive off the carbon dioxide from the stone; this amount is exactly known, and amounts to 3,255,000 British Thermal Units (B.Th.U.) per ton of lime, and represents the burning of about 2 cwt. of good average coal. This factor is unalterable by skill in kiln design, or care in operation. Secondly, there is a certain amount of heat required to drive off any moisture which may be present in the charge and to heat it up to the temperature at which the reaction takes place. It is true that some of this heat (but never as much as 50 per cent.) may be recoverable from the burnt lime as it is cooled in the lower part of the kiln. Next, some heat is needed to warm the air used for combustion of the fuel to the temperature of the reaction zone. Some of this is supplied by the heat in the cooling lime, but some also has to be provided by the fuel itself, and although in the upper part of the kiln a fair proportion of this heat may be recovered in warming the stone before it reaches the reaction zone, much heat always escapes with the gases from the top of the kiln.

Lastly, there are the heat losses due to convection and to radiation from the outside surface of the kiln, which can be minimised by thick walls containing non-conducting layers, but must always represent a very material fraction of the fuel bill.

When all these things are taken into account it is found that, in a well-designed kiln, it is not possible to produce a ton of lime with less than about $3\frac{1}{2}$ cwt. of coal, and it would be safe to say that the majority of kilns in England are using nearly double this amount.

When making lime from chalk, the amount of moisture commonly present in the chalk is so great that the necessity for its evaporation has an appreciable effect upon the amount of coal burned. An additional $\frac{3}{4}$ cwt. of coal per ton of lime produced is the calculated amount required for this purpose in the case of a normally damp chalk.

Types of Kilns.—There are innumerable designs of kilns, which have been more or less successfully used since the earliest system of burning lime in open clamps (not yet quite abandoned in this country) gave place to more economical methods. They range from tiny pot kilns, containing only two or three tons of lime, to enormous shaft kilns with a daily output of a hundred tons.

Pot Kilns.—In the small pot kilns, which have a more or less egg-shaped interior, the limestone and the fuel are put in in alternate layers. The first layer of limestone is laid (domed if there are no iron bars supporting the charge) on top of a thick layer of fuel supported on the kindling. When the kiln is full the fire is started and allowed to burn itself out. This method is very wasteful of fuel, but where only a small quantity of lime is needed, it is often the cheapest way of producing it at the spot where it is required. The chief difficulty that will be encountered in attempting to revive this simple practice is in obtaining the services of a lime burner who has enough experience to be able to superintend the process. Little kilns of this type are usually built of limestone or some other local stone and are not lined with fire-brick. The surface of the stone usually spalls off, particularly at first, but a more or less refractory slag then forms and seems to act as a preservative for the deeper layers of the stone. The somewhat ruinous remains of kilns of this type can be seen in almost all parts of our countryside.

One source of loss in these kilns is the fact that the kiln, as

well as the stone to be burned, has to be heated afresh for each charge. Despite this defect, there are much larger intermittent kilns of more elaborate design, which are occasionally used for burning special limes, although it is doubtful whether their use can ever be justified for agricultural lime, whatever their merits may be when used for hydraulic.

Draw Kilns.—The type of kiln in which the agriculturist is most likely to be interested is the shaft or draw-kiln. Here the process is continuous, not necessarily in the sense that the kiln is worked night and day, but continuous in the sense that the fire is only drawn when repairs are needed. Kilns of this type are frequently more than 50 feet in height, and should never be less than 15 feet, and even at this, the efficiency is not likely to be very high. The kiln is circular in plan and usually slightly bottle-shaped, and considerably smaller at the draw eye at the bottom than it is a little higher up where the greatest heat is developed. It is always lined with 9 in. or more of fire brick.

The principle upon which these kilns are worked is that, once the kiln is started, alternate layers of limestone and fuel are put in at the top in proportion as cooled burned lime is drawn at intervals from the bottom. As this is done the contents of the kiln slip down and a re-distribution and mixing of stone and fuel takes place. Each successive layer of fuel burns evenly and regularly as the flame and hot combustion gases from the lower layers reach up to it. It will be readily understood that in order to attain the maximum thermal efficiency it is necessary that the bed of burned lime below the reaction zone should be deep enough to enable the air entering the eye of the kiln to take up most of its heat before it is "drawn." In this way the air which reaches the fire is well warmed (on the regenerative principle) before it enters the "reaction zone," which is anything from 5 to 15 feet in depth, depending on the size of kiln and rate of working. Above this zone there should be room for a deep bed of mixed fuel and stone, through which the hot gases pass before they leave the kiln. In their passage they impart to it a large proportion of the heat which they carry, with the result that the stone is well heated before the actual burning takes place.

Coal producing much gas is liable to lose an important part of its calorific value during its passage with the stone through this pre-heating section of the kiln. If this defect be disregarded there is probably no type of kiln better calculated to

give a maximum yield of lime per ton of fuel burned. In order to avoid this loss and to obtain certain other advantages in the way of more direct control over the temperature, many kilns have been built, in which by one means or another, the stone is pre-heated by the waste gases before the fuel is mixed with it.

Ring-Fired Kilns.—One of the most thermally efficient, and perhaps most effective ways of pre-heating the stone alone, consists in building a kiln in such a way that the pre-heating section is of pronouncedly smaller diameter than the reaction zone, the step in size being made as sudden as possible, with the result that the stone, as it descends from the small part into the larger, leaves a considerable space between itself and the increased diameter of the kiln wall, into which it is possible to introduce the fuel, as required, by means of sloping passages in the kiln wall, fitted with fire doors. The re-distribution of the lime blocks, as they tumble down from above is relied upon to produce a sufficiently even mixture of stone and fuel. The distribution is, however, not usually as uniform in such kilns as when the coal and lime are fed together into the top of the kiln. There is therefore a definite limit to the ratio, diameter to depth of the reaction zone in kilns of this type.

In the case of each kiln so far described, the product as it comes through the eye is a mixture of lime and ashes. When the lime is exclusively for agricultural use, there is little disadvantage in this, and in any case a separation of the small lime and ashes can always be effected by handling it with forks when loading.

Separate Furnace Kilns.—In this kiln the lime is delivered in a purer condition than in the kilns described above, and is quite free from ash. This is accomplished by arranging that the fuel itself never comes in contact with the stone. It is burnt in furnaces built in the kiln wall, but out of the line of direct descent of the stone. By this means the gases from the furnaces containing the whole of the heat generated by the fuel (except a small proportion lost by radiation from the furnace crown and walls) enter the kiln through apertures in the side at the bottom of the "reaction zone"; here they mingle with the stone and pass up through the kiln, pre-heating the descending charge in the ordinary way. The regenerative principle can only be applied, however, if fans are used to draw the air for the furnace through the cooling lime. This system has the advantage that any type of fuel which may be available in the district can be used, and the

control of the process, from the temperature point of view, is very complete. Such a kiln can have the fires banked and be shut down at night with very small loss, and can be started up again in the morning, which advantage is not usually shared by the gas-fired kilns, next described.

Gas-Fired Kilns.—The cleanliness and ease of temperature control which are associated with kilns fired with producer gas, have rendered them very popular in the case of large lime plants, although it is questionable whether even in these cases the thermal efficiency can be as high as in the best types of coal-fired kilns. It is clear that the radiation losses from the gas producers must be an additional net dead loss in comparison with kilns in which the whole thermal process is confined within the kiln walls. The restriction of the ratio, diameter \div depth of the reaction zone, is even more limited in the case of these and the separate furnace kilns than with ring-fired kilns above referred to; otherwise the system is, in many ways, ideal. The lime produced is particularly free from any combination with combustion products from the fuel, and is of course without any ash. Since this system of firing is not likely to be adopted by small agricultural lime works, it is not proposed to dwell further upon its merits or demerits.

The Hoffmann and Rotary Kilns.—Two other types of kilns occasionally used for the production of agricultural lime should be mentioned, although in neither case are they to be recommended for small installations. The first of these is the Hoffmann Kiln, in which selected blocks of limestone are carefully stacked in such a way that passages are left for combustion gases and fuel in a series of chambers built in a ring. By a rather complicated arrangement of dampers, the various compartments of the kiln are brought into operation in sequence. Air is drawn through chambers in which the lime, still hot from being burnt, gives up its heat to it before passing into the chamber corresponding to the reaction zone, and the combustion gases pass on from this through chambers where the limestone is being pre-heated. Fuel is fed through openings in the tops of the chambers. The system produces excellent lime, but the labour of stacking the stone and the large radiation losses render the production of cheap agricultural lime impossible.

The Rotary Kiln is the last to be described. It is like a cement kiln in principle and construction. Small limestone from $1\frac{1}{2}$ in. down, is fed into the end of a long, rotating

steel drum lined with fire-brick, and in its passage is burnt to lime in contact with the flame produced at the opposite end of the kiln by means either of powdered coal or producer gas. The thermal efficiency is not very good and the upkeep is high. Such kilns are only useful to large quarry installations, where the small stone is a by-product, and unless converted into lime in this way, would be unsaleable.

Practical Kiln Construction.—Pot or shaft kilns can often be built so that natural support for three sides can be obtained by setting the kilns in a recess excavated in a cliff or bank; the front then remains the only structural part requiring special care. The charge exercises a bursting pressure much as water would do, and in tall shaft kilns great care must be taken that the front (usually flat on the outside) is well held up either by buttresses or by anchor ties connected by steel joists and well fixed in the rock at the back ends. Kilns which are without natural support are best finished circular and either held in by stout steel straps at frequent intervals or preferably encased in a ferro-concrete shell.

Kilns for heavy and continuous duty should be lined with fire lumps 12 in. or 15 in. from front to back and, say, 6 in. deep in the courses over the area of the reaction zone; otherwise ordinary fire brick laid in courses of headers will be found suitable. An ordinary brick backing should come next to this and then an expansion joint, say $\frac{3}{4}$ in. to 1 in. wide extending all round and for the whole height of the kiln, should follow.

The joint is best filled with carefully selected and completely burned clinker screened through $\frac{1}{2}$ in. mesh and rejected on $\frac{1}{4}$ in. mesh screen. This joint is useful in that it allows the inevitable expansion and contraction of the lining to take place without cracking the external shell, and also presents a very useful check to the conduction of heat from the lining wall outwards. Between the bricks surrounding the expansion joint and the external supporting shell (be it of reinforced concrete, stone, or brick), there is a space of variable thickness and section which must be filled, since thick walls are needed to keep the heat in, but the substance used is largely a matter of indifference, and in the writer's experience has ranged from good brick and masonry down through sun-dried clay lumps to quarry waste tipped in, without having any observable effect on the utility of the kiln.

Most draw kilns are open topped, but some have hoods, and some have a steel or other light shaft erected above

the hood. Hoods are apt to prove dangerous to the men charging the kiln by reason of the gases which collect in them, and unless the situation of the kiln is ill chosen with reference to the prevailing winds, hoods are best avoided.

The taller the kiln the better it is for draught, regenerative, and pre-heating efficiency, but there are two important limitations—(1) great height without proportionate increase in diameter so increases the radiating surface per unit capacity of kiln that the heat losses begin to increase, and (2) height must be proportioned to the resistance which the particular stone offers to crushing both before and after it is burnt. This consideration, if neglected, may lead to so much breaking up and packing of the charge that the draught is destroyed.

It is possible to burn a fairly crushable stone, such as oolite or chalk, in a tall kiln if either of the following devices are resorted to :—(a) The kiln lining may be made elliptical in plan in such a way that the major axis shrinks and the minor expands until they have changed places as it descends the kiln; (b) A pair of obstructing rounded shoulders may be formed in the lining so that the charge descends by a slightly zig-zag motion. By the use of either (a) or (b) much of the weight of the charge is taken upon the kiln walls rather than upon the lime in, or below, the reaction zone, and crushing is thereby minimised.

Single and therefore unsymmetrical draw eyes are objectionable, particularly in short kilns, because they cause uneven draught and descent of the charge. An arched circular passage entered from the front and built in the thickness of the wall at the base of the kiln has been successfully employed to enable four draw eyes to be conveniently worked in each of a battery of kilns with access to the front only. The size of the stone composing the charge may increase with the size of kiln. In a big kiln it is possible to burn thoroughly large blocks of stone which would leave a large residue of core if calcined in a small kiln. The more nearly the blocks are cubical (not flakes) and the more uniform they are in size the better will be the draught; a lot of small stuff in the charge fills the voids and makes a good draught impossible. The fuels which can be used in shaft kilns are limited to anthracite (small anthracite or "culm" is usually employed), hard steam coal, and gas coke.

Treatment of the Lime.—Now that lime is so comparatively expensive a product it is no longer reasonable to distribute it in lumps over the land and leave time and the weather to effect an even distribution, which, it may be added to their discredit, they never did accomplish. Something must always be done

to get the lime into a fine enough condition to apply with a distributor. It may be ground (in a disintegrator),* or slaked to form the hydrate $\text{Ca}(\text{OH})_2$. There is only one method known to the writer by which lime may be ground without making so much dust that the tending of the plant is almost beyond human endurance, and that one method consists in mounting the disintegrator on the top of a large air- and dust-tight storage bin (with sacking mouths at the bottom always sealed by ground lime). A wooden or sheet metal tube is led from the top of the bin into the feed mouth of the disintegrator. This tube suffices to return the dust-laden air, which is circulated by the fanning action of the disintegrator, to the machine again, and no air escapes to carry with it irritating lime dust. This arrangement obviates settling chambers, dust, balloons, etc., with all their inefficiency and expensive upkeep.

If it is decided to produce the hydrate, there is no necessity for a small concern to invest in any of the numerous hydrators. The essential thing is that water should be added in the right quantity and the right way to the lime when it is freshly burnt. The quantity of water needed is a hundred gallons per ton of quicklime. Theory requires that only 72 gallons should be added, but it is necessary in practice to allow for the water lost in steam, which is given off when the lime and water have been in contact for a short time. A good deal of evaporation also occurs during the mixing.

Many different methods of adding the water to the lime have been advocated, but if the correct proportion of water is strictly adhered to and an even distribution, followed by a thorough mixing, is secured, it matters little what the exact procedure may be. After mixing, the lime should be left undisturbed for 24 hours to allow the reaction to complete itself. Then, if the product is to be applied by means of a distributor, it must be screened through a $\frac{1}{4}$ in. or even finer screen to remove core, ash, flints, etc.

Lime hydrated in this way is an excessively fine, dry powder and can be safely stored in bags, as it will not swell like ground quicklime and burst the bags. It only takes up carbon dioxide from the air very slowly; not more than about 4 per cent. is found to be converted to the carbonate after exposure to the air in bags for a whole year. It therefore almost ranks with ground limestone so far as its convenience in handling and its

* For description of these machines see the June issue of the *Journal* (p. 204).

keeping qualities are concerned. It has an advantage over the former in that three-quarters of a ton of hydrated lime is chemically equivalent to a ton of ground limestone. One ton of pure burnt lime becomes $26\frac{1}{2}$ cwt. when it is hydrated, and it will therefore be seen that there is no reason why the farmer should pay fancy prices for the hydrate, which he can quite easily prepare himself from lump lime, or alternatively, why he should trouble to obtain ground lime, which not infrequently is largely composed of ground-up "core" (carbonate), ashes and air-slaked "small lime," and for which he is usually charged at least 5s. a ton above the price of good lump lime.

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SUFFOLK SHEEP.

S. R. SHERWOOD.

THAT which first attracts one in the Suffolk sheep is its thoroughbred appearance. The head, the legs below the knee and hocks are bare of wool and covered with fine, jet-black, glossy (not mossy) hair. The face is long, with a fine muzzle, especially in the ewe—indicative of a good breeder and milker. The eye is bright and full, the ears are thin, silky and alert, not drooping. When in full fleece the sheep bears a wealth of fine, dense wool, not shading off into dark wool or hair but clearly defined from the black head and legs and noted for its pure whiteness, fineness, elasticity and strength. The whole carriage is alert, showing stamina and quality. Indicative of the latter is the fine but strong, flat, clean bone of the leg. The skin is fine, soft and pink.

History and Progress.—The breed originated by the mating of the native horned ewes of Norfolk with Southdown rams. This is recorded by Arthur Young in his *General View of the Agriculture of the County of Suffolk* published in 1797; and the famous Coke of Norfolk was one who made the experiment. The resulting cross was immediately recognised as a fine butcher's sheep and soon became popular in East Anglia. By process of further crossing and selection a fixed type was evolved, and the Suffolk has been recognised as a pure breed since 1810. In 1886 all interests were united by the formation of the Suffolk Sheep Society and systematic keeping of records, and the breed quickly made its mark among the other breeds of Great Britain.

The annual carcass competitions of the London Smithfield Club are the supreme test of the meat-producing value of the various British breeds, and the results are of world-wide importance. The primary aim of the Club is "To encourage the selection and breeding of the best and most useful animals for the production of meat and to test their capabilities in respect to early maturity." At that Show in 1890 the first prize Suffolk wethers showed the highest percentage of carcass to gross live weight of any breed, and from that time onwards the breed has made steady and uninterrupted progress and has a record of successes in those competitions as mutton producers which to-day place it ahead of all other British breeds. Since the commencement of the competitions Suffolks and Suffolk crosses have won half the championships and reserves for championship; Suffolk lambs have, since 1900, won two-thirds of all the prizes in the short-wool lamb class; and Suffolks crossed with no less than ten different breeds have won half the total awards in the crossbred classes.

Factors in Improvement.—One of the first steps taken to bring about the improvement of the breed, and at that time a unique one, was the institution of flock competitions. Breeding flocks compete for challenge cups according to their size. The Bristol champion challenge cup is awarded each year for the best flock in the competition and another cup for the best ewe lambs. All flocks are inspected prior to first registration and every fourth year subsequently. This has done a very great deal to raise and maintain the general standard. No sheep is recognised as a purebred Suffolk unless it has the Society's registered mark and registered flock number of breeder tattooed in the left ear.

Popularity.—From the first the Suffolk has given evidence of its value as a good coloniser. As early as 1895, rams, lambs and ewes bred in France won first and special prizes at the Boulogne Agricultural Society's Show in open competition with other breeds. Reports from Canada and North America, Australasia, Chile, Peru, Brazil, South Africa and other places all testify to the remarkable way in which this breed adapts itself to its environment. Its adaptability to varying soils and climates—due to its inherent hardiness—is exemplified in the way it has spread over the whole of the British Isles, there being to-day registered flocks in no less than fifty-four counties. The Society's show and sale record points to the lively interest exhibited in these sheep all over the country; not only at the

Royal, the Highland, the Royal Ulster, Royal Dublin and leading County shows is this breed strongly represented, but in competition with other breeds at smaller shows and sales all over the country the Suffolk holds its own and its excellence for crossing purposes is evidenced.

The high level of prices for the general run of Suffolk sheep is probably unexcelled by any other breed. At the four principal lamb sales in 1920, 6,013 ewe lambs averaged £5 18s. 4d. with a top price of £40 per head for twenty. The 5,723 two-tooth ewes sold at the three principal ewe sales averaged £10 6s. 9d. with a top price of £61 per head for ten, while 1,800 older ewes averaged from £8 to £14. At the five principal sales of ram lambs, 1,255 averaged £22 9s. 6d. with a top price of £399. In 1921 Suffolks shared with all breeds in the general drop in values, but the keenness of the interest is unabated and new flocks are continually being established.

The following facts are indicative of the way the Suffolk has been taken up by Scottish breeders and graziers. Ten years ago one solitary registered flock held the field in the North; to-day, from Yorkshire northwards to the Cromarty-Firth, there are nearly 40 registered flocks and every promise of extension. Scotsmen are among the principal buyers at the Society's sales, in 1919 taking ram lambs at 135, 200 and 390 guineas, and in 1920 at 105, 150, 190, 200, 210 and 250 guineas. That these prices have not been given in vain is proved by the success of Scottish flocks in show and sale yard. The exhibit of Suffolk sheep at the Highland Society's Show is one of high merit, while those who have ventured to send South to the Royal and Smithfield Shows have taken high positions. At the Kelso ram sales in 1920, 361 Suffolk ram lambs, mostly bred in Scotland, averaged £22 16s. 7d. with a top price of £170. One-quarter of the whole of the awards won by Suffolk crosses at Smithfield have been won by Suffolk-Cheviot crosses from the North, while from August onwards Suffolk crosses frequently top the northern lamb sales. Suffolks and Suffolk crosses have won the championship eight times and reserve for championship seven times at the Scottish National Fat Stock Show. In 1919 Suffolks and Suffolk crosses were champions at Smithfield, Edinburgh and York. In Ireland the breed also does well: there are to-day registered flocks in 13 counties, and though they do not realise such high prices as in Great Britain they might do so if breeders brought them out in as good a condition and in show form. A few recognise



FIG. 1.—Suffolk Ewe Togs, 17 months old, in full Fleece.



FIG. 2.—Suffolk Ewe Togs, 17 months old.

the necessity of doing this and reap the reward—both as a good advertisement and also in prize money and sales—but as a rule they are not “done” well enough.

It is reasonable to believe that the Suffolk would not have spread as it has done nor won such success in competition with other breeds were it not for the combination of fine qualities it possesses. Its hardiness is proved by its success as a coloniser. In point of early maturity, well-grazed hoggets, under usual farming conditions, at the age of 8 to 10 months yield 78 to 84 lb. of dressed carcass, and the leading position maintained in the Smithfield carcass tests as above detailed is proof positive of it. The fecundity of the Suffolk, due to its Norfolk ancestry, is proverbial. As a New South Wales breeder well puts it:

“The beauty of this breed (I am referring to its bank account beauty) is that it produces both quantity and quality. My experience has been that single lambs are unusual, twins usual and triplets not uncommon.”

The average for all registered flocks for 33 years is 133.01 per cent. of lambs reared.

Wool.—The fleece as described above spins 56’s in Bradford counts. Mr. W. T. Ritch, Technical Instructor, American Wool Improvement Association, writing on January 15th, 1921, says:

“Your samples of Suffolk wool, both ewe and hogget, are the best types of medium Down wools which I have tested during the past ten years, either in Australasia, South Africa, South America, Canada or the United States. The length is good, the character excellent and the density is wonderful, while the colour, strength and elasticity leave nothing to be desired in Down wool.”

Writing again on February 14th after testing the second prize fleece at the Darlington Royal Show, he says:

“The crimp and lustre is good enough to satisfy the most fastidious judge of Down wool.”

Mr. J. Thomson Stephen, wool expert, Leicester, writing in the *Mark Lane Express*, December 1st, 1919, said:

“The various crosses of Suffolk sheep yield fleeces of grand character. Suffolk rams are very impressive in imparting their characteristic, to the wool of the sheep with which they are crossed. During the wool sales, where fine wools of the highest character in the kingdom are shown, a very large proportion were half-breds by Suffolk rams. I made a very careful inspection of these half-bred Suffolk lots, and in every instance they commanded the top prices of the day. They produce yarns of what is known as 57 to 58 counts, and these are the very qualities most in favour for all the finest grades of sound and durable hosiery fabrics.”

In the opinion of Mr. S. B. Hollings, a Bradford wool expert:

"A Suffolk fleece possesses exceedingly good, sound commercial characteristics. The quality is good 56's, the staple is nice length, sound and altogether ideal for hosiery purposes. So long as such fleeces are grown there will always be a healthy market, for wool of this character is more appreciated to-day than ever."

The average yield of Suffolk wool (washed) is for flock ewes from $5\frac{1}{2}$ lb. to 6 lb., and for shearling ewes first clip 7 lb. per head. The fleeces of sheep that are extra well done will weigh slightly more. It is among the top price wools in Great Britain to-day.

Management.—All the leading flock-masters retain the best ewe lambs of their own breeding, in most cases keeping considerably more than they require, for selection to make up the flock the following year, as it is impossible to tell for certain until then which will grow into the best sheep. The flock is made up a few weeks before mating, which in ram breeding flocks commences August 7th. The whole flock is carefully examined, all defective ewes being drafted, such as those with bad udders, delicate constitutions, unsatisfactory breeders, old and broken mouthed, etc. To facilitate this, ewes are sometimes earmarked as defective when in the lambing pen, as faults may be noticed then that might be overlooked at time of drafting. The shearling ewes are then very carefully examined to ensure that the very best are selected for making up the flock to the required number. Every year the utmost care should be taken to ensure that the flock is in a sound and healthy condition, and the ewes of as good a type and character as possible. If this is not done every year the flock will be sure to deteriorate.

The greatest care is taken in the selection of the rams. Good home-bred rams may be, and often are, used. There is much to be said in favour of this, as one knows exactly how they are bred. If and when outside blood is necessary every effort is made to secure the best without too great a consideration as to price. Ram lambs are chiefly used, but when one has proved a good sire it is used for several years.

It is advisable that the ewes should mate quickly to get a uniform lot of lambs born as early in the year as possible. The best of these are pushed on for exhibition at the shows and all the ram lambs kept going until the sales, the competition being very keen. The best of the ram lambs will weigh from 10 to

12 stone by 1st June. To ensure quick mating it is best that the ewes should not be in too high a condition. About a week before the rams are turned in the ewes should be put on good feed, nice aftermath grass or cattle-fed pasture or any fresh ground available, such as stubbles, with a fold of rape or thousand-headed kale.

It is found very beneficial if the flock can get an entire change for a short time on a farm that has been free from sheep for some time. If good, sound marshes are available that have not been sheep fed during the spring and early summer, flocks may be sent there to great advantage during the late summer and autumn, but many flock-masters have not this opportunity. About November the principal food is white turnips, with a run on stubbles, grass or heath land. A month before lambing a little trough food is given, about $\frac{1}{2}$ lb. per head of crushed oats, linseed cake and bran or malt culms mixed, to bring the ewes to the lambing pen with a plentiful supply of milk.

Some farmers have a permanent lambing yard, but it is preferable to have a fresh site yearly and as near the feed as possible. This is formed by standing two or three corn stacks on the selected site, pitching the straw to form shelter from the north and east winds. The yard is then built round this, separate pens being made for the ewes to come in as they lamb. Care is taken to see that the lambs are well mothered before turning out. When feeding white turnips before lambing, especially if it be a mild winter, the ewes should not be allowed too many; they should have a liberal allowance of hay or chaff, and if the turnips should have a disposition to run, that is, the tops shoot up, they should be horse hoed three or four days before folding to cut the tap root. During January, February and March the chief foods are white turnips, cabbage or kale, with a run out on grass, rye or early rye grasses, and if not too frosty a few mangolds thrown out. As soon as strong enough the lambs run forward through creeps, getting the pick of the food. Lamb troughs are kept in the forward fold and a little mixed trough food given, consisting of crushed linseed cake, oats and bran; if good clover hay can be spared this should be given in addition, either long or chaffed. By April there should be a plentiful supply of kale, cabbage, rape and rye grass, etc. When the lambs are young the ewes are kept generously, having 1 lb. per head daily of trough food, to keep up a good supply of milk. This is decreased as the lambs get strong and take a good supply of dry food on their own. In

May mixed clover and grasses begin to make headway. Early trifolium, rye grasses, etc., should be ready; a good store of mangolds must always be available and is an absolute necessity if the spring should prove a late one. The chief food for folding in June, July and August is tares. This should be drilled soon after harvest with a few beans or oats and a succession provided during the summer months, always with plenty of cabbage and mangolds—mangolds if possible—to last well in August. Nothing gives a better bloom to the lambs than white clover or sainfoin, but in some parts of East Anglia this latter does not flourish owing to lack of lime in the soil. August, which is usually a difficult time, must be thought of months ahead, and nothing is a more certain crop at this time than thousand-headed kale. Rape and cabbage may also be provided.

I consider late summer and September the most trying time for flock-masters; flies are insistent enemies even when sheep are carefully dipped. Lambs that are forced for sale are also apt to get feverish, breaking out with sore mouths and heads. This gives the flies their opportunity. Extreme care and attention is then necessary on the part of the shepherd, and frequently an entire change of feed is advisable. I should like to say that in many cases the ewes are docked far too short. The tail should always be left long enough to cover up and protect the parts. If this is not done and the sheep is at all feverish it again gives the fly a special opportunity, and irritation is set up causing great suffering to the ewe. Short docking should cease.

Non-ram-breeding flocks do not commence lambing until the end of February and March, and are treated in much the same way, but one does not go to the same heavy expense.

In conclusion, the management of a flock requires constant care and supervision. Much forethought must be exercised for the proper provision of food. No breed is likely to pay better than the Suffolk, which is very prolific, while none matures more quickly, and few breeds produce such good quality mutton.

BERKSHIRE PIGS.

SANDERS SPENCER.

It would appear to be probable that the breeders of Berkshire pigs would be able to make good their claim that there has existed a so-called Berkshire breed of pigs for a longer period than of any other of the present-day breeds, since pigs called Berkshires were exhibited at the Royal Agricultural Society's Shows nearly seventy years ago. It may be true that there was not a separate class for pigs of the Berkshire breed in the prize schedule, nor was there a class for any other special breed, since the classification is said to have been for white pigs and for coloured pigs.

From the illustrations published at the time, the Berkshire pigs which were successful at the earlier shows of the Royal Agricultural Society were of a black, red and white spotted colour. So far as one can form a judgment from the idealised sketches, the Berkshire of that period varied in form quite as much as in colour from the pig of that breed of to-day, as it was represented as long in the face, with prick ears, long body with good hams, rather high on leg and an infinitesimally small amount of bone. This length of body and lightness of head and offal were together most probably the chief causes for the great popularity of the Berkshire pig with the bacon curers in both England and Ireland about half a century since. The importation of Berkshire boars into the latter country by those interested in the bacon curing industry is said to have immensely improved the form of the native Irish pig and to have vastly increased the proportion of lean to fat in its carcass. This most estimable and valuable quality of cutting a large proportion of lean to fat meat is still retained to its full extent in the present-day Berkshire pig. Of this, abundant evidence is yearly afforded in the carcass classes at the Show of the Smithfield Club held annually in December at the Royal Agricultural Hall, where year after year the Berkshire exhibits have won the champion prizes in competition with nearly all the other breeds and crosses of pigs. Not only do we find evidence of the grand fleshing qualities of the Berkshire pig in the carcass section of this Show, but its success has been nearly as great in the live stock section, as most frequently the championships have been won by Berkshire pigs or by pigs of a first cross or those containing a larger or smaller proportion

of Berkshire blood. It has also been claimed that the suitability of Berkshire pigs for the manufacture of the class of bacon most in demand was one of the chief causes of the establishment of the large bacon factories which have existed for so long a time in Wiltshire and the adjoining counties. It is quite possible that the form and quality of the pigs of the district may have had some considerable amount of influence on the success of the bacon manufacturing industry, but it is equally possible that the fine quality of the pork and the large proportion of its lean to fat meat, due to the consumption by the pigs of the extremely large quantity of dairy offals available, may have had an almost equal amount of influence. At the present time nearly all the best bacon produced in these islands is from pigs kept in districts in which dairying and cheese-making are carried on to a large extent. The same remark applies to imported bacon, as the best of this is said to be produced in Denmark, Canada and Holland—in all these countries the dairying interest is specially noticeable.

This great popularity of the Berkshire pig appears to have led to its temporary undoing. It became fashionable amongst those men who had amassed fortunes in the United States and who in the seventies of the last century expended such large sums in the purchase of shorthorn cattle of the Bates and the Booth tribes. At the time named the breeding of pedigree shorthorns was largely in the hands of men of means and with somewhat large establishments where home curing of bacon was carried on and where the Berkshire pig had become a favourite owing to the high quality of the bacon produced from its carcass, particularly when the pigs had been fed on the dairy offals which were always more or less available in the large country houses. What more natural for the breeder of shorthorns when trading with an American to give a Berkshire pig or even two as a "luck penny" on having made a most profitable deal. Further, there is no denying the fact that a well-made Berkshire moves and looks the gentleman of the porcine breeds.

Unfortunately for the breed many of the imported Berkshires became the property of Americans who possessed a larger amount of money than of knowledge of the practical points of a pig. They were in fact mere fanciers who had taken up the breeding and exhibition of stock as a hobby or with a view to securing a certain amount of notice and popularity. The power to possess something dissimilar to the possessions of other people

also may have had a considerable amount of influence. This must have been the case or the attempt to transform the useful Berkshire into a short-headed, heavy-shouldered, short-backed pug of a pig would never have been attempted. This action on the part of the American fanciers might not have had so disastrous an effect on the breed had not the demand for this "improved" type of Berkshire extended to this country and had not our breeders of Berkshires been tempted by the extravagant prices offered for the type of pig made fashionable in the United States. It must not be forgotten that the farmers and many landlords were at that time passing through a period of great depression; all kinds of farm produce had become greatly reduced in value, whilst the seasons had proved of a most unfavourable character, so that the most up-to-date and so-called high farmers had suffered big losses and were thus easily tempted to spoil the Berkshire pig in order to become possessed of a greater number of American dollars. Fortunately, this craze for the small black type of Berkshire pigs did not continue for any length of time, but much harm was done and the popularity of the Berkshire was temporarily affected. The fancy for the diminutive Berkshire was like most other fancies—short lived.

The great improvement which had been made in one or two other breeds of pigs and the loss of trade together served as a stimulus to breeders of Berkshire pigs to regain for their favourites the leading position which they had lost. The short head, the heavy jowl, the wide shoulders and short backs were viewed suspiciously, since these special points had lost favour in the States and at the same time rendered their possessors of less value on the meat market. The change from the mere fancy to the utility type of Berkshire was so promptly and thoroughly carried out that pigs of the breed are now looked upon by purveyors of pork as quite the equals of pigs of any other breed. There is no doubt that the Berkshire carries a large proportion of lean to fat meat; it matures early in life so that it is suitable for the London porker trade which requires a carcass weighing from 60 to 70 lb., or for those markets in which fat pigs up to a weight of 200 lb. are required; the meat is of fine quality, the skin is fine and the offals are light. Thus the Berkshire is a profitable pig to kill. (Photos face p. 890.)

There is still one point which needs somewhat more attention from the breeders of Berkshire pigs than it appears to have received. This is the milking properties of the sows. The

quantity or the quality—we think it is the former—which some of the sows furnish is not sufficient to rear in the best possible manner a litter of ten pigs. Far too frequently the young pigs do not make the same amount of growth which pigs of some other breeds make ere they are three or four weeks old. This shortage of milk is also most probably the cause of that unevenness in size and development which is too often noticeable in a litter of Berkshire pigs. A complaint is also made by those who make a practice of selling their pigs as weanlings that they are too small to attract customers, most of whom look for size as an indication of growth in later life, but this apparent deficiency of bulk is largely due to the compactness and evenness of form of the Berkshire pigling.

The standard of excellence issued by the British Berkshire Society is as follows:—

Colour: Black with white on face, feet and tip of tail.

Skin: Fine and free from wrinkles.

Hair: Long, fine and plentiful.

Head: Moderately short, face chisled, snout broad; and wide between the eyes and ears.

Ears: Fairly large, carried erect or slightly inclined forward and fringed with fine hair.

Neck: Medium length, evenly set on shoulders; jowl full and not heavy.

Shoulders: Fine and well sloped backwards; free from coarseness.

Back: Long and straight, ribs well sprung, sides deep.

Hams: Wide and deep to hocks.

Tail: Set high and fairly large.

Flank: Deep and well let down, and making straight under line.

Legs and feet: Short, straight and strong, set wide apart and hoofs nearly erect.

Imperfections: A perfectly black face, foot or tail. A white ear. A crooked jaw. White or sandy spots, or white skin on the body. A rose back. A very coarse mane and inbent knees.

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FIG. 1.—Berkshire Boar : A noted prize-winner.



FIG. 2.—Berkshire Sow : Also a well-known prize-winner.



FIG. 1.—A good Hop Set (right), Hop Cutting (left).
Note 3 Shoots and Fibrous Roots on the Set.

CULTIVATION OF THE HOP CROP.

I.

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No British crop requires so much skill in cultivation nor so much technical and scientific knowledge on the part of the grower as the hop; each stage of the management will, therefore, repay the beginner who devotes to it endless observation and study.

Selection of Site.—The first problem is the selection of the site. Hop growing is carried out in well-defined areas, probably not so much by reason of the exacting nature of the hop plant for soil and meteorological conditions, important as these may be, as the fact that the hop requires very specialised skill and knowledge both on the part of the grower and also on the part of the labourers; beginners will therefore be well advised to start operations within or close to a hop district.

The site should possess a reasonably level surface, so that cultivations, and especially spraying, can be conveniently carried out. It should not be too exposed to the prevailing winds, or the crop may suffer great damage during growth and still more just before the picking of the hops; a well-sheltered situation is desirable or otherwise a situation that can be artificially well "lewed" by a poplar hedge or other device. A poplar hedge, properly cared for, grows very rapidly, but should nevertheless be planted two or three years before the hops so that it may begin to function as soon as the hops require protection.

The soil should be of considerable depth so that the deeply penetrating hop roots may get down several feet into the sub-soil and thus be able to supply the growing plant with moisture during periods of drought. In some cases this depth of soil may be dispensed with if the rock below is weathered and of a brashy nature so that the hop roots can still penetrate deeply; with this exception shallow soils are not suitable for hops. The texture of the soil may vary considerably; the best soil is a calcareous loam, free-working and yet retentive of moisture, but in such districts as the Weald of Kent and parts of Herefordshire certain varieties of hops are grown on heavy clay soils with great success. Light sands and gravels, and sour or badly drained soils are not suitable for hops. For the successful growth of hops, the soil must be very rich both in plant food and in humus. It is preferable that

the original soil should be of this nature, and for this reason freshly-ploughed grass (provided wireworms are controlled) may provide a suitable situation for hops. In other circumstances the fertility may be artificially supplied by the use of dung, dung-substitutes and other artificial manures.

Another essential condition is adequate drainage; in the case of hops the water table should not be closer to the surface than 30 in. This means that if artificial drainage is necessary the drain pipes should be laid 3 ft. below the general level of the surface. In any case if artificial drainage is required, it should be carried out before the hops are planted so that the subsoil may be brought into proper shape before the roots of the hops begin to grow.

Consideration should also be given to the situation of the field in respect of access for carting water for washing or spraying, travelling of pickers, carting hops to the oast, etc.

Preparation of the Site.—Before any other steps are taken the field should be mapped and a careful plan made, upon which should be recorded not only the sequence of varieties it is proposed to plant but also details relating to the type and construction of the wirework contemplated (see *Methods of Training Hops**), width and position of roadways, gangways, width of alleys and spacing between plants; this may need revision as new factors arise, but the existence of such a record in advance helps to prevent foolish omissions when actual planting occurs—omissions which can only be rectified at considerable expense.

Mention has already been made of the importance of drainage well in advance of planting; in close association with this careful attention should be given to the texture of the soil. In preparation for the preceding crops, ploughing should be increased in depth so as to provide a deeper root range for hops when planted; once also during this preliminary period it will be well to subsoil-plough the field, or alternatively use the steam cultivator to its fullest depth, care being taken that such deep cultivation is undertaken only when the subsoil is sufficiently dry to benefit by it. This deep cultivation, followed by the deep root-growth of the crops, will leave the soil in better condition for the growth of the hop roots and will render the drainage much more efficient.

During this period also the fertility of the field should be increased by the application of dung and other organic manures

* Mr. Amos will contribute an article on this subject in a later issue of the *Journal*.

as well by addition of such mineral manures as the soil may require.

Propagation and Planting.—Propagation of commercial hops is always “vegetative” by means of cuttings. Cuttings may be of two kinds—either the “straps” from aerial shoots of the previous season, or from underground stems or runners. The “straps” consist of the lowest 6 or 8 in. of the stem attached to the root stock, which have been earthed up in summer and swollen by the downward passage and accumulation of plant-food in late summer. In England these “straps” form the cuttings, runners rarely being used. On the Pacific Coast of America the cuttings are exclusively taken from the runners, because these are already supplied with rootlets and “strike” more easily, while they are less likely to dry out and die. More attention might be given to the use of runners for propagating “sets.”

In England the general plan is to grow the cuttings one year in the open field to form “sets,” and to plant them out into the hop garden at one year old; if, however, “sets” are unobtainable or are very costly, cuttings may be used for this purpose.

In selecting “sets” for planting it should be taken as an axiom that “the best are the cheapest”; each “set” should be well-grown with abundance of fibrous roots attached and with two or three good shoots. The “set” should not have withered leaves attached to the stems, since these indicate that they have been dug too soon in the autumn and will probably not grow; neither must they be “stags,” *i.e.*, “sets” which have grown two years in the ground and have developed coarse as distinct from fibrous roots. (*See illustration facing p. 891.*)

Planting out.—The season for planting extends from November to the end of March, and on most soils early planting is preferable to late because of the danger of the plants drying out; probably a dry spell in February offers the best chance of success.

Before planting is begun the land should be cleaned, if necessary, then deeply ploughed, after which the exact position of each hop-hill should be measured out and marked by a stick or poplar cutting.

If “sets” are planted, one good “set” only should be put to each “hill,” to avoid competition between plants, but if cuttings are used then two or three should be put to each. The “sets” are prepared by trimming the roots close back to the root-stock, and great care must be taken that they do

not dry out before planting. The best method of planting consists in dibbing a hole, putting the trimmed "set" in the hole so that the top is just above or level with the surface of the ground and pressing the soil tightly against the "set" by levering the dibber against it. If the weather is dry it is advantageous to scratch a little loose soil over the "set." When planting is finished the peg which marks the position of the "hill," should be replaced, so that the "set" can be seen and not be disturbed in subsequent cultivation.

It is of great importance that every "hill" should make a good start the first season, otherwise a very patchy crop will be produced the second season when, if the season is favourable, three-quarters of a full crop should be secured. It is, therefore, a wise policy to set aside up to 5 per cent. of the purchased "sets," trim them and plant them out in flower pots, so that, if upon examination in April it is found that some of the "sets" have died, the gaps may be replanted with potted "sets" and so produce a uniform plant.

If wireworms are present they are certain to attack the young hops and destroy the new shoots. To some extent this damage may be avoided by planting the "sets" not too deeply; further protection should be given by placing a piece of cut mangold about the size of a tennis ball by the side of each plant in March; the wireworms are attracted to the mangold and feed upon this instead of the hop-plant. The cut mangold can be examined once a fortnight with the object of collecting the wireworms and destroying them by scalding.

The young plants make much better growth and the resultant crop in the second season is benefited if short stakes or poles are provided upon which the shoots may grow during the first season.

The ground around the "hills" should be frequently cultivated, but care must be taken not to disturb the "sets" before they have taken root, or they are likely to dry out. The hops cannot take proper advantage of all the ground during the first year and a crop such as beans or potatoes, which are planted in wide rows, may conveniently be taken as an inter-crop; in this way the tillage of the inter-crop will at the same time benefit the hops, but such inter-crops must not be planted too close to the young hops lest they compete with them for plant food and water. On no account should sheep be allowed to eat the leaves of the young plants as when folding a crop of roots as an inter-crop, nor should the young "hills" be earthed up in their first year, or the result will be storage of plant food in the base of the

stems instead of in the root-stock; in the root-stock it provides a reserve of food for next season's growth, whereas the "straps" are cut off and so this reserve is wasted.

Cutting.—This operation is carried out for the purpose of keeping the hills in their place and preventing them from straggling all over the alley. It is desirable to keep the crown of the hill just level with the general surface of the ground. Two parts have to be cut off: the "straps" and the runners; on the Pacific Coast of America, where the hills are not earthened in summer, the operation is done with a sharp-edged spade; this is operated mainly for the purpose of cutting the runners, the spade being used to cut obliquely downwards and away from the hill. Under English conditions the hill is first cleaned from soil which has been put upon it during summer and then the "straps" and runners are cut off one by one with a sharp knife. The best time of year for this operation is during favourable weather in February or March, but may be carried out in autumn or as late as mid April.

Workmen often do much damage in cutting hops, being too severe on weak hills and too merciful to strong ones. The hops should be cut so that the crown is left just above the surface of the ground, in which position the young shoots are less liable to be attacked by wireworms. It is a frequent practice to scratch a little loose earth over each hill after cutting with the idea of protecting it; this idea is fallacious, for the stems arising from "hills" unprotected in this way are generally more firmly attached to the parent plant and less easily attacked by wireworms.

At the time of cutting attention should also be given to replanting any dead hills.

Cultivation.—The standard winter cultivation consists of two ploughings. *The first ploughing* is so managed as to turn the furrows towards the hills and so leave an open furrow down the centre of the alley. In the case of clay soils this first ploughing should be carried out very early in autumn so that the work may be done before the land gets wet and the open furrow may serve to keep the hop-plants drained through the winter. In the case of the more friable soils, where catch crops of rape and mustard are commonly sown before picking, the ploughing is delayed till the crop has been folded.

The second ploughing is carried out in spring as soon as the land is sufficiently dry for the purpose; this ploughing "gathers" the furrows to the centre of the alleys and levels

the land. Care must be taken that the last furrows next to the hills are not too deep, or too many hop roots would be cut.

The next operation consists in digging the "slips" between the hills where the plough has been unable to go, and at the same time the "hills" are opened for cutting.

Thorough spring cultivation should be given during March, April and May, whilst the soil is dry enough for tillage. This both kills weeds and aerates the soil. Spring cultivation should be above all things deep. Once in three or four years it is a good plan to use a steam cultivator at a depth of 12 to 15 in.; this not only provides for deep aeration but also facilitates drainage in the following winters and enables the soil to store up a greater quantity of water for the needs of the plant during summer. Another point to emphasize about spring cultivation is the fact that at this season it is not desirable to make the surface soil too fine; weeds can be more easily killed in a coarse-textured soil and, in the event of heavy rain, this sinks into the soil instead of being retained on the surface, making it sticky.

As summer proceeds the depth of tillage should be gradually lessened and automatically the texture will get finer; this is now desirable, since the fine soil at this season will form a mulch for the retention of water within the soil. Frequent cultivations are necessary as the surface gets beaten down by rain or trodden with other operations, for the purpose of aeration as well as to keep down weeds, but it is preferable to omit the cultivations rather than damage the texture of the soil by cultivating when too wet.

It is a moot point how long cultivation should be continued and probably the time should be varied according to the season, soil and quantity of manuring, etc., but in theory at any rate cultivation should be continued so that aeration may facilitate the production of plant food in the soil until the time when the hops are full grown. From this time onwards the supply of plant food should cease, because ripening and especially colouring of the hops is facilitated by withholding moisture and nitrogenous plant food from the roots. Late cultivation, by increasing the supply of plant food in the soil, tends to encourage the growth of new "bine" and "burr" so that the hops ripen in two crops. It also tends to delay the ripening of the plant generally. In practice it is difficult to decide at what stage to stop cultivation, and an interesting piece of investigation might be carried out upon this point.

(To be continued.)

INTERNATIONAL LABOUR CONFERENCE.

THE International Labour Conference recently held at Geneva devoted much attention to the conditions of agricultural labour, and although its conclusions on this subject do no more than affirm in many respects what is the common practice in this country, they constitute an interesting attempt to secure or ensure to agricultural workers throughout the world similar rights and privileges to those enjoyed by workers in other industries.

The first question that was put down for discussion was the regulation of the hours of work in agriculture on the analogy of the 8-hour day or 48-hour week which was the subject of a Convention at the first International Labour Conference held in 1919 at Washington. The French Government, however, lodged a formal protest against the inclusion on the Agenda not only of this question of the regulation of hours in agriculture, but also of other agricultural questions on the ground that it was not within the competence of the Conference as defined by the Peace Treaty to deal with agriculture, and, secondly, that even if agricultural questions could properly be regarded as coming within the scope of the Conference, the circumstances of the present time made it inopportune to discuss them.

A prolonged debate took place on these points but very little support was obtained for the suggestion that agriculture could be regarded as outside the scope of the International Labour Organisation. It was pointed out for example that although in the Peace Treaty the words "industry or industrial" constantly occurred, these words should be construed in the widest sense as including all forms of labour and that this meaning had already been given to them by the decision to deal with labour engaged in maritime shipping and in fishing. The "competence" of the Conference to deal with the question of agriculture was affirmed by 74 votes to 20.

Provision is, however, made in article 402 of the Peace Treaty to meet the contingency of a Government objecting to the discussion of any item on the Agenda, and in such a case it is laid down that a majority of two-thirds must be obtained to retain on the Agenda the item to which objection is taken. As the French Government had made a formal protest against the retention on the Agenda of the three items comprising the

agricultural questions, it was decided to take a vote on each item separately.

The subject on which feeling was most pronounced was the proposal for the regulation of the hours of work in agriculture. In the form in which this proposal was put to the Conference it amounted to no more than a recommendation that the regulation of hours of work should be voluntarily determined by agreement between organisations representative of employers and employed.

The question before the Conference at this stage was not, however, the merits of the proposal but merely the question whether this subject should be admitted for discussion. After considerable debate the matter was put to the vote and failed by five votes to obtain the necessary two-thirds majority, the figures being 63 to 39.

At a subsequent stage of the proceedings a Resolution was passed recommending that the question should be included in the Agenda of a future Conference.

This subject having been disposed of, there was little opposition to the remaining items relating to agriculture being considered and the necessary majorities were obtained without difficulty.

These agricultural questions were then divided into three groups and referred to separate Committees for consideration. The Committees reported, and after discussion certain Conventions or Recommendations were accepted and passed by the full Conference.

Prevention of Unemployment.—The Recommendation adopted on this subject dealt with the prevention of unemployment in agriculture from the point of view not only of directly taking measures to diminish unemployment but rather more generally to try to create a condition of greater stability and of increased employment of agricultural workers. In effect it merely suggests certain methods and invites the Governments to study those methods and to apply them as far as they can be made applicable in the particular conditions of each country, and to report how they work with a view to building up a body of information and experience amongst various countries.

The Recommendation is as follows :—

“Considering that the Convention and Recommendations concerning unemployment adopted at Washington are in principle applicable to agricultural workers and recognising the special character of unemployment in agriculture, the International Labour Conference recommends that each Member of the International Labour Organisation should

consider measures for the prevention of or providing against unemployment amongst agricultural workers suitable to the economic and agricultural conditions of its country, and that it should examine particularly from this point of view the advisability :—

(1) of adopting modern technical methods to bring into cultivation land which is at present not worked or only partially developed, but which could by such means be made to yield an adequate return ;

(2) of encouraging the adoption of improved systems of cultivation and the more intensive use of the land ;

(3) of providing facilities for settlement on the land ;

(4) of taking steps rendering work of a temporary nature accessible to unemployed agricultural workers by means of the provision of transport facilities ;

(5) of developing industries and supplementary forms of employment which would provide occupation for agricultural workers who suffer from seasonal unemployment provided steps be taken to ensure that such work is carried on under equitable conditions ;

(6) of taking steps to encourage the creation of agricultural workers' co-operative societies for the working and purchase or renting of land ; and of taking steps to this end to increase agricultural credit especially in favour of co-operative agricultural associations of land workers established for the purpose of agricultural production.

The International Labour Conference recommends that each Member of the International Labour Organisation furnish the International Labour Office with a periodical report dealing with the steps taken to give effect to the above Recommendation."

Compensation for Accidents.—In the case of this subject, there was general agreement that in those countries where forms of insurance against accidents were in operation, it was only reasonable that agricultural workers should enjoy the same privileges as other workers, and the Conference therefore adopted the following Convention :—

" Each Member of the International Labour Organisation which ratifies this Convention undertakes to extend to all agricultural wage-earners its laws and regulations which provide for the compensation of workers for personal injury by accident arising out of or in the course of their employment."

Rights of Association.—Similar considerations influenced the proposal to give to agricultural workers the same rights as industrial workers in regard to liberty of combination and association.

" Each Member of the International Labour Organisation which ratifies this Convention undertakes to secure to all those engaged in agriculture the same rights of association and combination as to industrial workers and to repeal any statutory or other provision restricting such rights in the case of those engaged in agriculture."

Insurance against Sickness, Old Age, etc.—Here again similar arguments applied, the intention being merely to afford the agricultural worker similar privileges to industrial workers. In this case, however, the Conference adopted the form of a Recommendation rather than a Convention as giving greater elasticity in view of the fact that social insurance might be adopted under special terms and conditions for certain groups of workers which could not be made applicable either generally or to agricultural workers as a group.

“That each Member of the International Labour Organisation extend its laws and regulations establishing systems of insurance against sickness, invalidity, old age and other similar social risks to agricultural wage-earners on conditions equivalent to those prevailing in the case of workers in industrial and commercial occupations.”

Technical Agricultural Education.—In regard to the desirability of encouraging the development of vocational agricultural education there was practical unanimity and the following Recommendation was adopted :—

“That each Member of the International Labour Organisation endeavours to develop vocational agricultural education and in particular to make such education available to agricultural wage-earners on the same conditions as to other persons engaged in agriculture.”

Women Workers in Agriculture.—Two Recommendations were adopted as regards women workers in agriculture, one relating to the protection of women before and after childbirth and the second relating to the employment of women at night. As regards the first, it may be observed that although this country has not accepted in its entirety the Maternity Convention of Washington, women workers have in practice in the National Health Insurance Acts similar privileges of a more extensive nature to those contemplated by the Convention.

In regard to the employment of women at night, this is, of course, very rare in Great Britain, and would only occur when the term night includes the early morning.

The Recommendation relating to maternity was as follows :—

“That each Member of the International Labour Organisation take measures to ensure to women wage-earners employed in agricultural undertakings, protection before and after childbirth similar to that provided by the Draft Convention adopted by the International Labour Conference at Washington for women employed in industry and commerce, and that such measures should include the right to a period of absence from work before and after childbirth and to a grant of benefit during the said period provided either out of public funds or by means of system of insurance.”

The Recommendation concerning night work of women in agriculture was as follows:—

“That each Member of the International Labour Organisation take steps to regulate the employment of women wage-earners in agricultural undertakings during the night in such a way as to ensure to them a period of rest compatible with their physical necessities and consisting of not less than 9 hours, which shall, when possible, be consecutive.”

Children and Young Persons.—A very similar Recommendation was made in regard to the employment of children and young persons during the night. It will be observed that in both these Recommendations the period covered by the term “night” is not defined, the only requirement being that both in the case of women and children a definite period of rest shall be ensured.

The Recommendation concerning night work of children and young persons is as follows:—

(1) “That the Members of the International Labour Organisation take steps to regulate the employment of children under the age of 14 years in agricultural undertakings during the night in such a way as to ensure to them a period of rest compatible with their physical necessities and consisting of not less than 10 consecutive hours.”

(2) “That the Members of the International Labour Organisation take steps to regulate the employment of young persons between the ages of 14 and 18 years in agricultural undertakings during the night in such a way as to ensure to them a period of rest compatible with their physical necessities and consisting of not less than 9 hours, which shall be consecutive.”

A Convention was also agreed upon that had for its object the prohibition of the employment of children under the age of 14 in agriculture during the hours of school attendance. In the case of this country the Education Act of 1918 provides for the compulsory attendance of children up to the age of 14, and the provisions of this Convention are in accordance with existing practice so far as Great Britain is concerned.

The Convention concerning admission of children to employment in agriculture was to the following effect:—

(1) “Children under the age of fourteen years may not be employed or work in any public or private agricultural undertaking, or in any branch thereof, save outside the hours of school attendance. If they are employed outside the hours of school attendance, the employment shall not be such as to prejudice their attendance at school.

(2) “For the purpose of practical vocational instruction the periods and the hours of school attendance may be so arranged as to permit the employment of children on light agricultural work, and in particular on

light work connected with the harvest, provided that such employment shall not reduce the total annual period of school attendance to less than eight months."

(3) "The provision of Article 1 shall not apply to work done by children in technical schools, provided that such work is approved and supervised by public authority."

Living-in Conditions of Agricultural Workers.—In many countries this question is one of considerable importance, and the Recommendation adopted is intended to secure improved conditions in those cases where housing accommodation is provided by employers. It runs as follows:—

"That each Member of the International Labour Organisation which has not already done so take statutory or other measures to regulate the living-in conditions affecting agricultural work in its country and after consultation with the employers' and workers' organisations concerned if such organisations exist.

"That such measures shall apply to all accommodation provided by employers for housing their workers either individually or in groups or with their families whether the accommodation is provided in the houses of such employers or in buildings placed by them at the workers' disposal.

"That such measures shall contain the following provisions:

- (a) "Unless climatic conditions render heating superfluous, the accommodation intended for workers' families, groups of workers or individual workers, should contain rooms which can be heated.
- (b) "Accommodation intended for groups of workers shall provide a separate bed for each worker, shall afford facilities for ensuring personal cleanliness, and shall provide for the separation of the sexes. In the case of families, adequate provision shall be made for the children.
- (c) "Stables, cowhouses and open sheds should not be used for sleeping quarters.

"That each Member of the International Labour Organisation take steps to ensure the observance of such measures."

It may be thought that comparatively little has been effected by the considerable machinery that is brought into play at an International Conference. Probably agriculture is of all industries least susceptible to international regulation, but something is accomplished if this fact comes to be realised after full discussion between the parties concerned—the employers, the workers, and the Governments. From the purely national point of view, again, British agriculture stands to gain if the restrictions on the unlimited use of labour which are dictated by humanity, and have become customary under our social conditions, can be thus incorporated in the practice of other competing countries.

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THE PRODUCTION OF SEED POTATOES IN CUMBERLAND AND WESTMORLAND.

MAJOR OSWALD RILEY,
Ministry of Agriculture.

It has long been recognised that the counties of Cumberland and Westmorland, owing to essential climatic conditions, are capable of producing seed potatoes of high quality suitable for planting in the midland and southern counties. It is evident that those growers who, foreseeing the inevitable spread of Wart Disease throughout the country, are specialising in the production of seed of immune varieties, are becoming alive to this fact. A large number of growers in Cumberland received the Ministry's certificate of purity for immune varieties in 1920; in fact, in cases of the more popular varieties 30 per cent. of the total number of growers of immune varieties in England and Wales were Cumberland farmers. In the near future there is certain to be an ever-increasing demand for "seed" of these varieties, and Cumberland growers would be well advised to organise this industry at once and place it on a sound basis.

An association of growers who could supply seed potatoes of the best quality, guaranteed to be grown in the best districts in Cumberland, would create a regular demand for their produce in the south, and the southern grower would be able to obtain first-class "seed" at a moderate price. From the point of view of the national food supply and the productiveness of the land, such a scheme might have a far-reaching effect, as without doubt the present low tonnage grown per acre, especially in the southern counties, is largely due to the use of poor "seed" or "seed" grown under unsuitable conditions.

The horticultural inspectors of the Ministry, in carrying out the work of crop inspection, have been able to collect valuable information as to the most favourable districts for raising seed potatoes in Cumberland and Westmorland, but while it is possible by means of personal inspection and observation to form an opinion as to suitability or otherwise of any particular district for this purpose, it is more satisfactory and convincing to prove this by means of statistics of climatic conditions, compiled during a long period of years, and at the same time to compare them with similar records taken in other potato growing districts which have already established a reputation for the production of seed potatoes.

Particulars of Districts.—For convenience, Cumberland may be divided into four districts, "A," "B," "C" and "D." There is only a small area in Westmorland suitable for potato growing, and that is included in District A. The observation stations from which the meteorological records have been taken are as follows:—

District "A" Newton Rigg, 559 ft. above sea level.

" "B" Scaleby (east), 111 ft. " "

" "C" Aspatria (west), 487 ft. " "

" "D" Braystones (for rainfall only), 50 ft. above sea level.

District "A" is bounded on the north by the Carlisle-Newcastle railway, on the south by the Clifton-Appleby-Kirkby Stephen railway, on the east by the Pennine Range and on the west by the Carlisle-Penrith-Clifton railway. The soil is a loam to light loam. The formation in the east is Kirklington and St. Bees sandstone and in the west sandstone and breccia.

The highest altitude at which potatoes are grown is 950 ft. and the lowest 300 ft. above sea level, the average being 450 ft. This is probably the best district in England for growing seed potatoes, as the soil and climatic conditions are uniform throughout. The conditions at Newton Rigg, the observation station, though just outside the boundary, are typical of the district.

District "B" is bounded on the north by the Scottish border; on the south by the Maryport-Carlisle-Newcastle railway; on the east by the Northumberland border and on the west by the Solway Firth.

The soil varies from light loam on the sandstone, alluvial on the alluvium, to heavy loam on the Keuper Marl and lower lias. The formation in the east is Kirklington and St. Bees sandstone, in the west Keuper Marl, and on the coast alluvium.

The highest altitude at which potatoes are grown is 750 ft. above, and the lowest at sea level, the average being 200 ft. This district is nearly as suitable for potato growing as district "A," but there is a greater variety of soil and the climatic conditions are not so uniform.

District "C" is bounded on the north by the Maryport-Carlisle-Newcastle railway; on the south by the Penrith-Penriddock railway; on the east by the Carlisle-Penrith-Clifton railway and on the west by the Fell country.

The soil is a heavy loam, and the formation is of a limestone series. The highest altitude at which potatoes are grown is 800 ft., and the lowest 350 ft. above sea level, and the average 400 ft. This district is mostly laid down to grass, and therefore only small crops of potatoes are grown.

District "D" is bounded on the north by the Whitehaven-Cleator Moor road, by the Duddon Sands on the south, the Fell country on the east and by the sea on the west.

The soil is light loam running to sand on the coast line. The formation is Kirklington and St. Bees sandstone. The highest altitude at which potatoes are grown is 400 ft., and the lowest at sea level, the average being 50 ft. This district is on the Cumberland coast and is suitable for the cultivation of early varieties of potatoes.

* The altitudes and soil formations are taken from the Ordnance Survey.

Factors Influencing Seed Production.—In determining the most suitable county or district for the production of seed potatoes for planting in more southern and warmer counties, the factors outlined below should be taken into consideration, and while in some districts certain suitable factors may be present to an exceptional degree, yet those districts could not be considered suitable for producing seed potatoes unless *all* the essential conditions were present.

(1) *Soil.*—The best soil is a loam or light loam, and for the latter a fairly heavy and regular rainfall is necessary in order that the seed may not become over-ripened. These conditions are found in districts "A," "B" and "D." The lightest land is usually found near the coast. In District "B" there is a certain amount of heavy loam running out to loam nearer the coast, and most of the potatoes in this district are grown on the loam.

(2) *Temperature.*—The mean temperature should be a low one and below that of the county to which the seed* is to be supplied. The temperature during the growing months, *i.e.*, April, May, June, July and August, should be sufficient to encourage luxuriant and healthy growth, and should be regular without being extreme. The temperature during the ripening months, *i.e.*, September and October, should be moderate in order that premature ripening may not take place. There is only a slight difference in temperature between the three Cumberland stations previously mentioned and the five Scottish stations situated at Dundee, Perth, Leith, Kilmarnock and Dumfries, Newton Rigg with 46.4° F. being the lowest, and Leith with 47.9° F. the highest. Taking the mean temperature for the growing months there is little to choose between the three Cumberland and the five Scottish stations. For May the Cumberland and Scottish stations average the same, *viz.*, 50° F., and Newton Rigg 49.6° F. For June the Scottish stations show 55.7° F., and Newton Rigg 55.7° F. For July Scottish stations show 58.3° F., and Newton Rigg 58.4° F. and for August Scottish stations show 57.4° F., and Newton Rigg 57° F. In most months Aspatria and Scaleby show a temperature slightly higher than Newton Rigg. Other potato growing counties of England have a much higher temperature, *e.g.*, Lancashire 59.5° F. in August and Lincolnshire 61.3° F. in July; this is accompanied by a much lower rainfall.

For the ripening months there is little difference between the Cumberland and Scottish stations, the average for each being

* Late or main crop varieties are referred to.

practically the same, viz., in September, Cumberland 53.9° F. and Scottish 53.7° F.; in October, Cumberland 47.8° F., and Scottish 47.2° F. Newton Rigg shows the lowest temperature of all the stations for these two months, viz., 53.2° F. and 46.7° F. Lancashire and Lincolnshire are again several degrees higher.

(3) *Hours of Sunshine*.—Long hours of sunshine are very important during the months of growth, both for the formation of starch and the general health of the plant. Damp, sunless days favour the spread of blight and other fungus diseases. Too much sun at the end of the growing period and during the ripening period, if accompanied by a low rainfall, will produce over-ripened "seed." Scottish areas compare unfavourably with the Cumberland stations in hours of sunshine during May, June, July and September, but are nearly equal in August and October. Lancashire shows a distinct shortage of sun. Newton Rigg records more hours of sunshine in June than any other station, including Kew. This is the most important period for the formation of starch. The following is the average number of hours of bright sunshine each day for the two Cumberland and two Scottish stations

		<i>May</i>	<i>June</i>	<i>July</i>	<i>August</i>	<i>Sept.</i>	<i>Oct.</i>
Cumberland	...	6.18	6.60	5.82	4.98	4.50	3.01
Scotland	...	5.67	6.18	5.43	4.84	3.98	3.04

(4) *Rainfall*.—It may be generally stated that 35 in. to 40 in. per annum is an ideal rainfall for potato growing on loams and light loams. The rain which falls during the growing months should be sufficient to produce regular and vigorous growth and should be evenly distributed, without any periods of drought: the latter produces either premature ripening, or if followed by heavy rain, second growth. The driest period should be at the time of lifting. A sufficient rainfall is essential in April and May in order to start growth, and in June, July and August to stimulate it. A large number of rainy days indicates a constant and regular rainfall without periods of drought. In all these respects Cumberland compares very favourably with other potato growing districts, the rainfall being as high as in the chief potato growing districts of Scotland, while the number of rainy days is greater.

(5) *Altitude*.—Seed potatoes grown at high altitudes are less likely to become baked by the sun or to ripen prematurely. As a rule they are harvested later than in low-lying districts, when the sun has less strength, so that the final ripening is a gradual process and is not over-hastened by hot weather. There is also

the change, which is of value in planting on low ground, seed which has been grown at a much higher altitude, the difference in climate between the two altitudes being a strong factor.

(6) *Situation*.—Undulating land is more suitable for the production of seed potatoes for the following reasons:—

(a) Drainage is better (probably the land will be naturally drained), and so potato crops are less liable to disease, *e.g.*, Corky Scab, which thrives on undrained land.

(b) On undulating land potatoes are less liable to attacks of Blight which spreads rapidly on low-lying flat land. This is probably in a large measure due to the absence of air currents which are always present in undulating country.

(c) The sun, which is necessary for the formation of starch, has the greatest effect in this respect on land sloping to the south, and most arable farmers grow their potato crop on their best-situated fields. On such land the hottest rays of the sun (at noon) strike the ground obliquely, but later in the afternoon, when the rays are cooler, at more of a right angle, and so the heat of the sun throughout the day is moderated, and the greatest possible amount of starch is formed without fear of over-ripening. The reverse is the case on flat land, where the rays of the sun are not so moderated during the day but are more intense at noon and cooler in the evening. The whole of district "A" in Cumberland is undulating, and very few, if any, potatoes are grown on flat land. The same applies to districts "B" and "D" to a lesser degree.

(7) *Common Diseases*.—It may be safely stated that potatoes grown in Cumberland and Westmorland are, as a rule, remarkably healthy and free from disease. Though such diseases as Blight, Corky Scab, Black Leg, Mosaic, Leaf Curl, etc., are often present as in most potato growing districts, yet they are seldom severe enough to injure the crop to any considerable extent, and frequently little trace of these diseases can be found.

(8) *Capacity For Producing Heavy Crops*.—County trials have proved that with proper cultivation and manuring certain Cumberland soils can produce as heavy crops of most varieties of potatoes as are produced in other counties.

(9) *Accessibility of Markets*.—Owing to present high railway freights Cumberland growers have a good opportunity to build up a seed business by offering their potatoes at a moderate price to midland and southern growers who cannot afford to buy Scotch seed. Cumberland growers would thus greatly

benefit by securing a regular market and southern growers by an increase in crops. As county agricultural education progresses, growers in every county will become more alive to the necessity of obtaining suitable seed each year, without which the potato crop is always uncertain and frequently unremunerative.

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INTERNATIONAL POTATO CONFERENCE.

THOUGH the potato has only been in cultivation in this country a little over 300 years it has long been a valuable article of food and now contributes a considerable amount to the national larder. It was estimated that between the years 1909 and 1913 the potato formed about one-fifth part by weight of the food eaten by the people of the United Kingdom; but until the period of food difficulties during the great War, the extent of our dependence upon the potato crop was realised by but a few. During this period strenuous efforts were successfully made by farmers, market gardeners, allotment holders, and private gardeners to raise such a quantity of potatoes as would provide a home-grown store of food in the event of imports of food supplies being very considerably reduced, or cut off completely.

The potato is not confined to the United Kingdom or to Europe, but is grown as a food crop, to a greater or smaller extent, in most places with a temperature varying between certain limits. Germany, with an area of over six million acres, grows more potatoes than any other country, France coming second with just over half that acreage, and the United Kingdom third with an area approximating to one and a quarter million acres; other countries grow smaller areas. It is estimated that the world's acreage devoted to this crop is about 33,000,000, with a total production of some 123,000,000 tons; the average yield, therefore, being about $3\frac{3}{4}$ tons per acre.

The yield is largely influenced by certain natural factors, such as soil, temperature and rainfall; as well as by methods of culture. It therefore varies widely in different countries, being highest in Belgium with 6.1 tons per acre. In the United Kingdom the yield is approximately 6 tons, Germany 5.9 tons, Denmark 5.7 tons, France 2.8 tons, and the United States

2.6 tons. The yields obtained in hot countries, like India, have not been ascertained, but they are understood to be small.

Those engaged in the potato growing industry in these countries are convinced that, under certain conditions, it is possible to lift crops of double and sometimes treble the weight of the average yield, and there is a great work to be done in every country in order to discover the factors limiting the size of the crops, and the means whereby these factors can be wholly or partially removed. In most instances it has been discovered that improved yields could be obtained by the use of improved strains of seed, and by the control of certain diseases to which the potato crop appears to be particularly susceptible.

Thus it was natural that the Delegates in Conference at the International Potato Conference held at the Royal Horticultural Society's Hall, Westminster from 16th-18th November, should more or less confine their discussions to these most important aspects of the matter. Mr. Wm. Stuart (U.S.A.), Mr. F. J. Chittenden (England), and Mr. Wm. Robb (Scotland), in their papers, showed that by selecting tubers from robust, vigorous plants it was possible to eliminate weak plants, and to build up strains superior to the unselected. There was agreement, however, that yield was not increased to the same extent as by using for seed tubers derived from crops grown in colder regions suitably supplied with a plentiful rainfall. The importance of this is now recognised generally, and just as England has chosen Scotland and northern Ireland as districts from which to obtain seed, so other countries are trying to discover suitable areas for producing their seed tubers. Thus, India obtains seed potatoes from Italy, Egypt from Spain, Bermuda from certain Canadian areas, and the growers in South America from selected fields in the north.

The home produced potato, therefore, does not appear to have retained its full powers of reproducing a crop, a discovery which had led to the popular belief that potatoes degenerate when continuously reproduced by asexual processes, *i.e.*, from tubers. Dr. Salaman (England) explained that this was not the true explanation, that continuous asexual reproduction had nothing to do with degeneration, and also that it was impossible to attribute the degeneration, if it existed, to general senile decay of the potato. He suggested that the loss of vigour was attributable to deterioration of the stock brought about by pathological diseases, and cited "Mosaic disease" as one of the causes.

Papers on Wart Disease read on the second day really focussed on the use of immune varieties for soils infected with the disease as the best solution of the problem for the present. Two readers expressed doubts as to the stability of the immune varieties, and Dr. Brierley in particular held to the possibility of immune varieties breaking down, and appealed for more research on the problem of soil sterilisation.

The delegates on the third day dealt with the "virus diseases" such as "Mosaic," "Leaf Curl" and "Crinkle," on which subjects Dr. Quanjier (Holland) gave a most interesting and instructive paper. Mr. Murphy (Ireland) gave, in a thoughtful address, an account of the work which he carried out on these diseases in Canada; whilst Mr. A. D. Cotton (England) reviewed the position in so far as Great Britain was concerned.

Judging from the papers there can be little doubt that the disease reduces the yield of the crop very materially, and that the productiveness of those varieties peculiarly susceptible to these diseases is impaired in a few years. It would also appear that improvements in the crops of most countries would be secured under some system by which tubers from healthy crops were only retained for planting.

Those interested in these matters should obtain a copy of the Report of the International Potato Conference which the Royal Horticultural Society has arranged to publish. All the papers read at the Conference, as well as the Presidential Address by Sir Daniel Hall who was unavoidably absent from England during the progress of the Conference, will be included in the report. Copies will be obtainable shortly from the Secretary, Royal Horticultural Society, Vincent Square, Westminster, London, S.W.1. Price 3s. 4d. post free.

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STRAWBERRY GROWING IN THE CHEDDAR VALLEY OF SOMERSET.

A. D. R. WALBANK, N.D.A.

Ministry of Agriculture.

CHEDDAR VALLEY is situated about twenty miles south-west of Bristol and is completely protected from the north and partially from the east by the Mendip Hills. The Valley extends from the village of Cross to the county town of Wells, but only the area lying between Axbridge and Draycott is used for strawberry growing. A branch line of the Great Western Railway serves the Valley. The Mendip Hills rise fairly steeply out of the Valley, and it is chiefly in "pockets" on the slopes of these hills, and at their base, that market gardening is carried on. Although the geological formation is carboniferous limestone, at least three types of soil are met with—a brashy soil on the higher slopes; a light red marl; and a black soil, which does not appear to be entirely devoid of clay in the lower levels.

Growth of the Industry.—Market gardening has flourished in the district for many years, but the introduction of strawberry growing on a commercial basis dates back only some 35 years. It was first commenced at Axbridge. For several years market gardeners were suspicious of the financial returns to be derived from the new crop, but when the ordinary early vegetable crops of the district realised lower prices in Bristol market there was a rush to take up strawberry growing, which reached its maximum about fifteen years ago. It then suffered a gradual decline, which was accentuated by various disturbing conditions operating during the war-period. At the present time the area under market gardens is probably about 650 acres, of which some 300 acres are under strawberries. Other crops are early potatoes, peas, beans and turnips.

Strawberries are usually left down for three years and are cropped as one-year-old plants. The principal variety grown is Royal Sovereign, but a few Kentish Favourites, Laxtons and Nobles are to be found. When the three-year-old plants are removed, potatoes and other crops follow for two years to admit of thorough cleaning before planting strawberries again. During the past year it is estimated that 60-70 acres of market garden land has reverted to strawberries; a few new holdings are also being developed. Suitable land is still obtainable between Cheddar and Draycott, and there appears to be no reason why

the strawberry growing area should not be extended in the direction of Rodney Stoke and Lodge Hill. The chief feature of the district is its earliness.

Size of Holdings and Types of Growers.—The average size of the holdings is about two acres. Many growers hold considerably less, others more, but holders of ten acres are few and the writer knows of only one holding of 20 acres. The larger holdings are usually worked as joint family concerns. In one instance, three brothers who are considered prosperous men support themselves and their families on seven acres of market garden land, three acres of which are under strawberries. They have, in addition, five acres of grass for pasturage and hay for the horses. Strawberry growing necessitates very close application to work at certain seasons of the year, and it is considered locally that two acres (one of which is under strawberries) is enough for one man to look after, except in the picking season, when outside labour is employed. The majority of growers rent their holdings. Rents vary from £2 to £7 per acre, according to situation, and a fair average is £5. Rates are approximately £1 6s. per acre.

Rather less than one-half of the growers are entirely dependent on market gardening for a living. The majority combine other work with it: some are in business as tradesmen or small shopkeepers; others are farmers; the remainder obtain casual labour during the winter. Thus a type of worker is evolved who is only semi-dependent on his holding, who retains considerable independence, and who is better off financially than a labourer. The poverty line is seldom reached and the growers generally are a contented class.

System of Cultivation.—Strawberries usually follow early potatoes or peas, and it is the practice to take runners from one-year-old plants as soon as rooted. Growers endeavour to ensure that the runners are planted not later than the second week in August, as it is from the early runners that the earliest fruit is obtained. The usual distance between the rows is 2 ft. and the plants are about 9 in. apart. This allows of nearly 27,000 plants per acre. Wherever possible, growers prefer to use farmyard manure, but where this is unobtainable various artificial manures—generally bought as compound strawberry manures—are used. The young plants are heeled in practically on the top of the artificials. Some growers give a small dressing of sulphate of ammonia or superphosphate in the early spring. The estimate in the district for manure is £10 per acre.

Cultivation after planting is devoted entirely to keeping the land clean. About January the space between the rows is forked by hand. This is termed locally "spitting in" and one man will fork an acre in 12 days. During the spring the land is hoed as required, generally at least twice, and one man will hoe an acre in 6 days. Strawing down the plants is not usually practised, but a few growers use bracken for this purpose if no dung has been applied.

Growers' Organisation.—The Cheddar Valley Fruit Growers' Association was formed in 1912 and largely owes its inception to the Agricultural Organisation Society. It is affiliated to the National Federation of British Growers, and has a membership of about 160. The Association has a strong marketing committee, which meets nightly throughout the season and virtually decides the markets to which the following day's crop shall be consigned. It also gives valuable assistance to the Railway Company by indicating the probable number of railway vans required, and their destinations. The question of a guarantee of the weight of fruit in each chip (at present this is 4 lb. net) is being considered by the Association, which is also concerned with the difficulty of obtaining adequate supplies of manure. It arranges lectures for growers by the County Horticultural Superintendent in the winter months; and it is drawing up a scheme to establish, at its own expense, variety and manurial trials with strawberries, with a view to exploring the possibilities of further local development.

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BEE-KEEPING IN NORFOLK.

H. GOUDE,

Horticulture Adviser to Norfolk County Council.

In the initial stages of all industries, when they are struggling to gain recognition, there is a time when the application of advanced knowledge and wise legislative assistance will lead individual efforts to a collective and full realization of their aims. Bee-keeping goes back to the dim ages, but modern apiculture has developed improved methods and bees during the past few years, and is just emerging from the infant stage of a re-birth to take its place on the wide road of vigorous maturity with a modicum of paternal fostering.

The Norfolk Education Committees have encouraged bee-keeping for more than twenty years; they have proved that the craft will bear favourable comparison with any of the minor industries of the country-side, and that it is, in fact, a profitable adjunct to both agriculture and horticulture. The Norfolk villages of Feltwell and Methwold are mentioned in the Domesday Book as being good districts for keeping bees, proving that our forebears did not neglect apiculture. With no substitutes for honey and wax, bee-keeping was for them a major occupation. The two villages mentioned are first-class positions for bee-keeping to-day.

Scheme of Instruction.—The general scheme of practical instruction provides for demonstrations at shows, and for lantern lectures during the winter evenings. These two items of work bring the expert in personal touch with bee-keepers and prospective beginners, and directly lead to visits to apiaries. Some of these apiaries are used as demonstration centres for the district: a demonstration is advertised and from twenty to forty people attend. The expert shows a seasonable operation and many of the audience—frequently the majority—perform the same work on different stocks of bees under his supervision. In this way, skill in manipulation is increased, and confidence in handling bees gained. A close touch is kept with these demonstration apiaries; monthly reminders are issued and further visits made at important periods in the season. At the end of the season an expenditure and receipt account is made out for each centre.

Norfolk Demonstration Apiaries.

<i>Apiary No.</i>	<i>Number of stocks.</i>	<i>Weight of surplus honey.</i>	<i>Season's expenditure.</i>	<i>Season's receipts.</i>	<i>Profit.</i>
			£ s. d.	£ s. d.	£ s. d.
1. ...	7 ...	493 lb. ...	3 15 0 ...	39 6 0 ...	35 11 0
2. ...	13 ...	1,000 „ ...	22 10 0 ...	108 0 0 ...	85 0 0
3. ...	8 ...	559 „ ...	10 7 6 ...	57 7 6 ...	47 0 0
4. ...	8 ...	196 „ ...	5 7 0 ...	12 5 0 ...	6 18 0
5. ...	2 ...	50 „ ...	10 0 ...	3 15 0 ...	3 5 0
6. ...	17 ...	1,121 „ ...	19 0 0 ...	93 0 0 ...	74 0 0
7. ...	7 ...	300 „ ...	2 10 0 ...	22 10 0 ...	20 0 0
8. ...	14 ...	998 „ ...	15 0 0 ...	74 17 0 ...	59 17 0
9. ...	1 ...	48 „ ...	5 7 ...	3 14 0 ...	2 7 5
10. ...	2 ...	123 „ ...	17 6 ...	9 4 0 ...	8 16 6
11. ...	3 ...	78 „ ...	11 0 ...	7 7 0 ...	6 16 0

In these balance sheets ten per cent. is allowed for *depreciation* on the capital expenditure; this is found to be ample, as the equipment of an apiary is serviceable at the end of ten years, and even at the end of twenty years. The cost of wax foundation and frames should be reckoned as capital expenditure as they remain in the apiary five years, but the cost of these is charged as current expenditure. Everything that is bought for the production of honey, wax, bees and maintenance is included. Time is not charged for, owing to the difficulty in assessing it, and beginners usually waste time in unnecessary work. The balance sheets from the centres include the results from some of the most skilful bee-keepers who readily availed themselves of the instruction.

The county scheme also provides for grants to local societies for approved work; the teaching of bee-life and the making of bee hives in elementary schools; and the establishment of a county apiary. Several elementary schools have practical bee-keeping classes.

Acarine disease practically depleted the county of bees from 1910 to 1914, and bee-keeping was abandoned in places where it had flourished. This was a most disheartening period. The introduction of Italian queen bees, obtained chiefly through the Ministry of Agriculture's scheme, has had excellent results; the county has again many thriving apiaries and progress is still being made. Within a mile of East Dereham there are 100 stocks of bees built up since 1914. With actual results in view it is estimated that Norfolk is capable of producing an annual average output of 1,000 tons of honey. Bees are a potential source of food, as the nectar secreted by flowers is entirely lost if not gathered by them.

Fig. 1 shows one of the apiaries built up under the guidance of the county expert; each hive contains a thriving colony of bees, and the produce last season was half a ton of honey, a few pounds of wax and six stocks of bees.

Practical Work.—In the practical instruction the British Bee-keeper's Guide Book is used as the source of information, but we also read the bee literature published in America, in the Colonies and the home journals, "skimming the cream" of any new ideas and trying them out. Past experience makes us cautious in adopting new inventions until we have appraised their value. It is advisable to keep to the smallest number of simple appliances consistent with efficiency, and to become thoroughly skilful in their application rather than have a multi-

plicity of tools and methods. The W.B.C. type of hive is recommended; its possibilities of extension and contraction fulfil all practical demands. This hive is a perfect home for bees if kept painted so that it is watertight. In the same manner the British standard and shallow frames serve every practical purpose.

Italian bees are favoured owing to their docility and powers of working. They are less susceptible to brood diseases than other races. A few queens are imported each season and introduced to the stocks in each apiary. The best of these pure queens are kept for breeding in their second season; the resulting bees are vigorous and with few exceptions very easy to handle.

The position of the apiary should be sheltered from prevailing winds and in a dry position; for the latter reason a grass bottom is not desirable, but gravel, ashes or cultivated land are preferable. Bees thrive best in a dry, warm, light, airy and quiet position; shade from trees is a disadvantage. Full advantage can be taken of an open sunny position by painting the hives white. In the spring we stimulate the queens by uncapping stores and interchanging combs, but unless the weather is warm the brood nest is not split. Syrup feeding is started in April, if necessary. Towards the end of April the strongest stocks are doubled, and if the season is early all the stocks crowding the brood chambers are supered in May. The first super consists of shallow frames containing brood combs, narrow spaced, as an addition to the brood chamber. Queen excluders are then put on and further supers added when necessary. This system gives very few swarms. The bees begin work on the cherry, plum, apple and bush fruit blossoms. Raspberry honey is particularly good. The blossoming of these fruit trees is closely followed by bean, sainfoin and clover, and, later, by turnip, cole seed and buckwheat. The important point in summer management is to keep large colonies of bees, with ample room for storing, ready to take advantage of any nectar flow which the crops and weather produce.

Comb honey is taken from the hives as soon as it is sealed, once every nine days during the season. The sections are then cleaned, graded and packed away (Fig. 5). The extracted honey is taken when convenient, or left in the hives until August; but farmers usually prefer doing this work in July, before harvest commences. The hives are then put into trim for wintering and doubtful stocks re-queened.



FIG. 1.— Apiary built up under expert supervision.



FIG. 2.—Uncapping shallow Combs for placing in the Extractor (on the right).

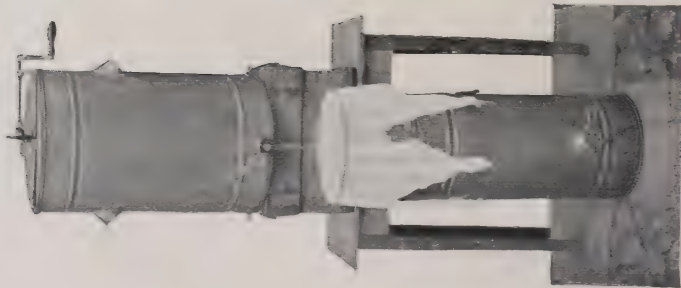


FIG. 3.—Running Honey from
Extractor through muslin into
Refiner.



FIG. 4.—Bottling Honey ready for sale.

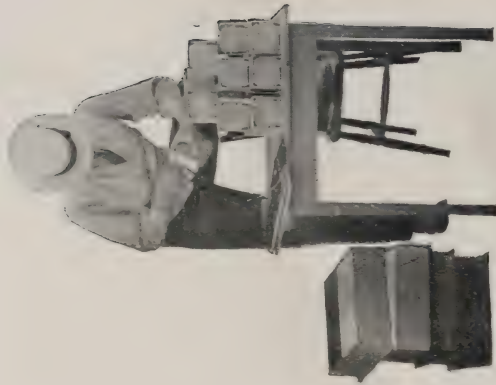


FIG. 5.—Cleaning Sections of
Comb Honey.

The principal points to remember throughout the year are to have the best queens, strong stocks, ample stores, and weather-proof hives. The surplus honey combs are taken when all cells are sealed, the cappings are cut off and allowed to fall into the top of a ripener lined with butter muslin, and the honey is extracted (Fig. 2). When the honey in the extractor reaches to the spindle socket, the cappings in the top of the ripener are tied up, and the muslin bag thus made is hung over a basin to drain. A clean piece of muslin is now placed over the ripener and the honey in the extractor is strained as it is run into the ripener (Fig. 3). The honey is now free from particles of wax and ready for putting into jars (Fig. 4). Plain glass jars are used, and every effort is made to make the jars of honey bright and neat. An attractive label is used and the honey readily sells.

The Committee has found that one year in ten produces an exceptionally good supply of honey; one year is very poor, and the remaining eight years vary from good to moderate. In 1911 the late Mr. Bunkle, of Brancaster, obtained two tons of honey from 21 stocks of bees, while the flow in the following year was very poor. In 1921 the supply proved exceptionally good.

The intensive and extensive development of apiculture is seriously menaced by casual keepers of bees. For instance, an old infected hive left in an out-of-the-way place in a garden is repeatedly tenanted by straying swarms. Disease sets in and the bees die. The stores are then robbed by bees from apiaries miles apart, setting up new centres of infection. In several instances the writer has traced the source of the ruin of hundreds of stocks of bees to this careless practice. At present there is no law to prevent the sale of old infected hives which spread ruin to apiaries over wide areas. This retards development; the experienced bee-keeper hesitates to put more "eggs" into his bee-keeping "basket."

The abstract value of apiculture to agriculture and horticulture is of considerable importance, and the annual loss of hundreds of tons of one of Nature's choicest foods should be rectified.

TESTING STATIONS FOR AGRICULTURAL MACHINERY.

AGRICULTURAL Machinery Testing Stations have been established in many continental countries:—France, Germany, Austria, Scandinavia, Holland and Belgium. Italy too is soon to have one. The object of such a station is to test, scientifically—which means also practically—such machinery as may be submitted to it, and to issue reports thereon, public or confidential as the case may require. To these functions it may add the collection—both in the course of actual trials as well as from other sources—of all data bearing on the subject of agricultural machinery; and investigations, both theoretical and practical, on such questions as may from time to time suggest themselves. The station may or may not add education to research.

To take a concrete instance. Sweden, with a population of about 6 million (or roughly 1/6th of that of England and Wales), has two testing stations—Ultuna and Alnarp. A Director of Testing is responsible for the work at both stations, each of which has a staff consisting of a professor, an assistant engineer, a farm manager and two mechanics. The number of machines tried in 1914 was 200; in 1916, 82 (Ultuna 46, Alnarp 36). It should be mentioned that Alnarp specialises in milking machinery. Both these institutions owe their existence to a gift in 1896 of some £5,000 from the Separator Company, a gift which at any rate so far as the Company is concerned, seems to have been particularly well placed, to judge from the reputation for dairy machinery which Sweden enjoys to-day. In addition to the two testing stations for agricultural machinery, there is in Stockholm a testing station for materials, which possesses what is considered the most modern laboratory equipment for the purpose in the world.

The programme of the two testing stations is simple. There are, on the invitation of the Testing Committee, public trials (known as trials in series) designed to test a number of implements having a similar purpose. Besides this any individual may for a fee, graduated according to its value, submit a machine for trial, or for expert opinion. Reports on the public trials are published. The publication of the report of an individual trial is, with certain restrictions, at the discretion

of the entrant. At any trial the manufacturer has the right to be represented.

The reports are comprehensive documents, which, to take as an instance an individual trial of a tractor and plough, may extend to some 40 octavo pages. In addition to more or less obvious heads of information, such as draw-bar pull, brake tests, adaptability of tractor for haulage and stationary work, the report includes details as to behaviour, especially in steering and turning, safety of the engine, number of interruptions with their duration and cause, ease with which parts can be replaced, and comparison, where possible, with a single furrow horse plough. The practical ploughing trial was carried on for 14 days. The result of the brake tests are given in a table accompanied by a graph showing consumption of fuel at the various developed h.p. A short conclusion, in simple terms, sums up the detailed report.

The reports of comparative trials or trials in series are also comprehensive and are the more illuminating in that each phase of the trials is represented in tabular form showing the performance of each implement.

Trials are not merely conducted in the field. Many details admit of, if they do not absolutely require, investigation in the laboratory. Nor are all trials concluded when the machine, whatever it is, has been returned to the owner. The value of many implements of cultivation cannot be thoroughly tested until the crops, sown on the ground which they have worked, have been harvested, and it is interesting to note in this connection a Swedish account of trials of subsoiling ploughs in which comparative yields of the first crop taken (wheat) are included in the final report. It can with justice be urged that one cereal crop is not very adequate evidence on so debatable a subject; an absolutely scientific test might be held to require no less than a whole rotation: but the immediate point to be noted is the principle which governs the inclusion of such data at all in the report.

Any one single testing station is not dependent solely on itself. One of its duties is, as already explained, the collation of data already obtained elsewhere and, as is shown later, there is among the European stations a considerable amount of agreement as to the lines on which such data should be recorded.

Thus the merits and shortcomings of previous machines of any given type can be fully ascertained, and accumulation of experience from the past may obviate the need for fresh

experimental work or may determine the direction which experimental work shall take.

Another direction in which this accumulated experience will be of service is in the preparation of reports of trials. So long as every machine is practically regarded, for the purposes of the trial, as a new machine and as such submitted to test, the working up of the mass of detail collected will involve much labour and tend to delay the publication of reports. Results already recorded both at home and, still more, abroad will serve as a standard of comparison; they will indicate the points to be stressed, and may even show where a new machine falls short of a predecessor; they may also enable the detail contained in current reports to be cut down to a minimum, although it may be questionable whether in the long run there is much to be gained in this way.

As regards the method of drawing up reports it may be noted that most of the Continental Stations are in accord with one another. The question of uniformity in this respect was raised at a conference of International Agricultural Engineers, the first of its kind, held at Liège in 1905. At the International Agricultural Congress (which included at the same time the Second International Conference of Agricultural Engineers), held at Vienna in 1907, Professor Josef Rezek, of that city, whose services in this direction can scarcely be too highly appreciated, brought before the agricultural machinery section a recommendation as to the general lines that should be universally adopted in drawing up reports on tests of agricultural machinery. This, with a few amendments, was agreed to, as were also a number of other similar recommendations dealing in detail with different types of machinery. These instructions, though leaving open to some extent the methods to be employed, lay down the lines on which scientific testing should proceed and thus tend to promote uniformity.

Every phase of applied science has its special problems, and the problems of agricultural engineering are perhaps more specially complicated than, and often very different from, those with which other branches have to contend:—

(1) The bulk of agricultural machinery must be capable of working efficiently under a wide variety of conditions both of soil and weather.

(2) The machine must be economical in use, and to meet this requirement must, broadly speaking, be produced in mass.

(3) There is no purely practical method of testing its efficiency that will not in general require at least one season.

A plough, for instance, may do admirable work, when only the actual operation of ploughing is considered, but, as was pointed out by a witness examined by the Departmental Committee,* the resultant crop may not be commensurate with the apparent quality of the purely ploughing work accomplished. A rotary cultivator may produce, or appear to produce, an excellent tilth in one operation, but its work needs to be tested by the touchstone of economics—which is to-day a crystal of many facets. A drill may deposit seed and fertiliser ideally, but its true value cannot be appraised until it has been established how, among other things, the resulting crop has tillered.

The solution of the first of these three problems must be mainly sought on the lines of the closest co-operation between the mechanic and the soil physicist, to whom must be added the botanist and the plant pathologist.

The two other problems scarcely admit of independent solution; they are inextricably intertwined with one another. The task of producing in mass an implement that cannot, according to present method, be fully tested in less than a season is one that makes many demands upon the manufacturer. It is true, as has been indicated above, that he has the collected experience of centuries to help, nor is he without means, commensurate with the extent of his business, of testing any new design or proposed modification before it is placed on the market. Still there is the danger, greater of course in smaller establishments, lest either partiality to a design or inefficiency of test should result in leaving on his hands a serious quantity of unmarketable stock, or, worse still, of placing in the hands of the farmer a relatively inefficient tool.

From such a danger an impartial testing organisation, fully equipped with staff and material, would be a considerable safeguard. The fear lest the tendency of such a body would be to suppress individuality and circumscribe the scope of private enterprise is sufficiently dispelled by the whole history of such institutions abroad. For a manufacturer who looks beyond his own country for a market, the value of such an institute, ever collecting and collating information from every quarter of the globe, issuing a certificate which would be everywhere accepted without question, and offering, if desired, technical advice

* [Cmd. 506] 1920 p. 61.

based upon scientific methods and broad experience, would be incalculable.

Many of the countries that once imported freely have either been schooled by circumstances to provide for their own needs or have been reduced in purchasing power. They will buy nothing unless convinced that they are buying what is better and in the long run cheaper than what they can themselves produce. Failure of any implement placed on a foreign market will prejudice indefinitely not only the firm but the nation producing, and the less qualified the purchasers are to account for the failure, the deeper roots their prejudice will strike.

Agriculture was the first-born of human arts. It has changed, no doubt, since the period chosen as a setting of the earliest and noblest of human stories, which saw in the first inhabitant of our world a gardener, and a keeper of sheep and a tiller of the earth in his sons. Our need of it, however, is not one whit the less. Never perhaps in the history of humanity has there been so real, so purposeful a resolve to beat swords into ploughshares. Never certainly in the history of humanity has there been so sore a need that the converted product should be economic and efficient.

* * * * *

LAND DRAINAGE AND UNEMPLOYMENT.

At the beginning of November a substantial sum of money was placed at the disposal of the Ministry for carrying out drainage schemes with the primary object of relieving unemployment.* Out of this Fund, advances are made by the Ministry (a) to Drainage Authorities, and (b) to County Agricultural Committees, to defray the cost of drainage schemes submitted to and duly approved by the Ministry.

Drainage Authorities are required to repay to the Ministry 25 per cent. of the net cost of each scheme within six months of its completion.

Agricultural Committees, which can only carry out schemes on a purely voluntary basis, are required to secure from the affected landowners and occupiers undertakings to repay $33\frac{1}{3}$ per cent. of the estimated cost of each scheme. This repayment may in suitable cases be spread over a period not exceeding two years, the deferred payments bearing interest at 5 per cent.

* See this *Journal*, December, 1921, p. 839.

The conditions upon which money is advanced by the Ministry under this scheme may be repeated here. They are as follows :—

- (a) All work must be done as far as possible by hand labour ;
- (b) 75 per cent. of the labourers must be ex-service men, if available ;
- (c) Of the remaining 25 per cent., the majority must be married civilians, if available ;
- (d) Wages payable for ordinary labour will be the agricultural rates current in the district. The only men who may be paid in excess of the agricultural rates are gangers, foremen and skilled men such as carpenters and smiths ;
- (e) The works will be inspected by the Ministry from time to time and progress reports will be called for as and when required.

The main object to be achieved is to get unemployed rapidly on to suitable work, and every possible effort is being made to prevent any formalities standing in the way of work being started promptly.

The possibility of undertaking works of land drainage, or of reclamation, for the relief of unemployment, or of assisting such works financially, has been discussed for many months, and many prominent agriculturists and others have urged that such a policy should be adopted.

The suggestion that works of reclamation, particularly on the foreshore of the Wash, should be undertaken by Government has also been very freely advocated, and is undoubtedly attractive at first sight. There are, however, in the Ministry's opinion almost insuperable difficulties. Work of this kind would have to be carried out on remote and exposed parts of the coast and would involve housing accommodation for large numbers of men as well as provision for supplies, amusement and policing, in most cases at a considerable distance from rail-head. It will be readily understood that such necessities as these would add enormously to the cost of any work, and also that the first requirement for keeping down the cost would be the employment of the greatest possible number of men at a time on each work. It will also be evident that, owing to the situation of the works, the conditions during winter would be extremely unfavourable and calculated to lead to long periods of almost complete idleness.

In any case, the construction of embankments by hand labour is an extremely uneconomical method of reclaiming foreshore land at the present time. Experts have been considering the possibilities of using machinery of various kinds for such

construction, and other researches have led to the conclusion that in the near future, if not at the present time, embankments can be constructed by machinery at a very much lower cost than by hand labour. The adoption of such mechanical appliances would, to some extent, overcome the difficulties of housing and winter weather conditions, but would render the work comparatively useless as a means of relieving unemployment. It was mainly therefore on account of these difficulties that the Government decided that no works of foreshore reclamation should be undertaken with the funds now available.

Land drainage work, on the other hand, by which is meant, generally speaking, the improvement of water courses with a view to the diminution of the injurious flooding and water-logging of agricultural land, undoubtedly offers far greater opportunities for useful relief works. It is even capable of being carried out during the winter, and the difficulties involved are comparatively small. It was therefore decided that the fund at the disposal of the Ministry should be used only to assist works of land drainage.

The primary object of the Ministry is the relief of unemployment in rural areas. The unemployed workers in these areas are generally found in small groups over scattered districts, and it will be apparent, therefore, that more effective relief can be afforded by a large number of small schemes employing comparatively small numbers of men, than by a small number of large schemes in isolated areas. Moreover the larger the number of schemes the wider distributed becomes the benefit to agricultural land.

A further very substantial advantage of land drainage works as compared with works of reclamation is that the former, if interrupted by bad weather, can be resumed at any time where left off, without any substantial amount of the work having to be done over again; moreover, land drainage works are not necessarily confined to small schemes, and in suitable cases larger works can be undertaken within a short distance of urban areas which will relieve not only agricultural workers, but considerable numbers of unemployed men from the towns.

The offer of assistance which has been made by the Government has up to the present been taken up very satisfactorily. Up to the 17th December, 49 schemes submitted by Drainage Authorities and 13 schemes submitted by County Agricultural Committees had been approved.

The estimated number of men to be employed was 3,003, and the estimated number of man-weeks was 50,204. The estimated cost of the schemes was as follows:—

Wages	...	...	...	...	£105,639
Materials	...	...	...	...	8,772
Special staff and supervision	...	...	...	...	4,004
Total					£118,415

The comparatively few schemes which have actually been put in hand by County Agricultural Committees does not indicate any want of activity on the part of those bodies. On the contrary, in a large number of Counties, meetings of land-owners and occupiers have been held to consider numerous schemes, and agreements to repay to the Ministry the prescribed percentage of the cost of the schemes are being obtained. The difficulties, however, of organising voluntary schemes of this nature are obvious, and it is not to be expected that such schemes will be anything like so numerous or so large as the schemes submitted by Drainage Authorities.

In conclusion, two interesting points may be mentioned which have been prominent in the reports of the Ministry's Inspectors. The first is that there has been no difficulty in obtaining unemployed men of the class which it is particularly desired to relieve and that all available ex-service men have been employed in every case. The second point is that the men are taking readily to the work and are doing far better than was generally expected, although the work is not only trying but is entirely new to the majority of them.

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THE BARN-OWL.

WALTER E. COLLINGE, D.Sc., F.L.S.

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For ages past the commoner species of owls have been regarded by farmers and landowners as most beneficial birds, but during the past few years, when the character of many wild birds has been called into question, that of the Barn-Owl (*Strix flammea*, Linn.) has been greatly maligned. Stories which have been told of its depredations on young game birds and rabbits, even in broad daylight, have been too quickly believed and passed on.

In 1919 the writer prepared a note* giving a volumetric analysis obtained from an examination of twelve stomachs secured between March and October. Since that date he has had the opportunity of examining further specimens, and the figures

* *Journ. W.B.I. Soc*, 1921, Vol. i, p. 9.

remain practically the same. Moreover, from the Eastern and Midland counties of England a large series of pellets has been received and examined, and in view of the results obtained, it seems very desirable to re-state the case for this useful and interesting species, particularly at a time when farm vermin has



FIG. 1.—The Barn Owl (*Strix flammea*).¹

greatly increased and is imposing a severe tax upon the agriculturist. Too often the farmer and landowner do not bear in mind the enormous number of rats, mice and voles that are destroyed by this and other species of wild birds. If any professional rat-catcher were to guarantee the destruction of a tithe of these, he would be welcome to take payment in a brace or two of game birds.

The Barn-Owl is common and resident throughout Great Britain and Ireland, though it is less numerous in the north of Scotland. It is strictly nocturnal, remaining asleep during the daytime in old ruins, barns, church towers and other buildings, and occasionally in the hollows of trees. At dusk it flies abroad, seeking its sheltered retreat as day breaks. If unmolested it frequents inhabited places, indeed seems to prefer the vicinity of houses, etc., to the open country.

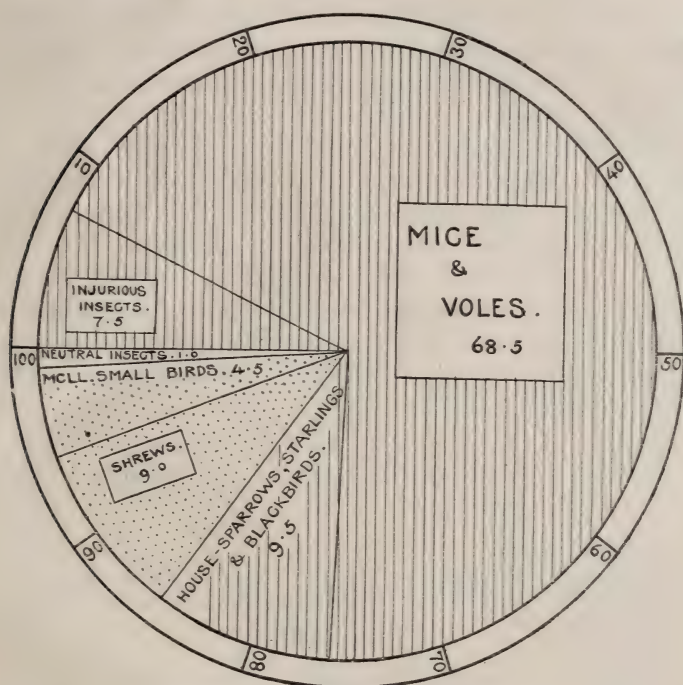


FIG. 2.—Diagram showing percentages of food consumed.

The call " is a loud, harsh, and most weird-sounding shriek which is more frequently uttered during the pairing season than at any other time; and early in the evening, when the bird commences its nocturnal peregrinations, the cry is most often heard."

Its eggs, 3 to 6 in number in a clutch, are laid at intervals of indefinite duration, and several broods are reared in the year, from the middle of April onwards. The eggs are pure white, somewhat dull, without any gloss, and slightly elongated.

Practically every investigator who has inquired into the feeding habits of the Barn-Owl has acclaimed it as one of the birds most beneficial to the farmer and landowner; it is therefore to be

greatly regretted that others should endeavour to besmirch its character and destroy it.

An analysis of the stomach contents shows that the food consists entirely of animal matter. Of the total bulk consumed 68.5 per cent. is composed of mice and voles, 9.5 per cent. of small birds (house-sparrows, starlings and blackbirds), 7.5 per cent. of injurious insects, 9 per cent. of shrew mice, 4.5 of small birds (finches, etc.) and 1 per cent. of neutral insects. The bird is beneficial in regard to 85.5 per cent. of its food (Fig. 2).

The enormous percentage of mice and voles destroyed at once draws attention to the benefit that this bird confers on the farmer, and even if there is any truth in the charges which have been brought against it in recent years of occasionally taking young game birds, the percentage of any such food is infinitesimal when compared with the remainder. It has frequently been pointed out that when the Barn-Owl is abroad seeking its food, all young game birds are safe beneath their mothers' wings.

Adams* has recorded that in 1.124 pellets he found remains of 2,407 rats and mice, of which, however, 469 were shrew mice.

In the writer's examination of 410 pellets it was possible to identify the following:—

Mole	...	...	...	...	...	5
Short-tailed Field Mouse (Field Vole)	...	...	...	...	...	62
Bank Vole	...	...	...	...	...	34
Long-tailed Field Mouse	...	...	...	...	...	149
House Mouse	...	...	...	...	...	25
Common Shrew Mouse	...	...	...	...	...	64
Brown Rat	...	...	...	...	...	125
House-Sparrow	...	...	...	...	...	122
Blackbird	...	...	...	...	...	11
Starling	...	...	...	...	...	12
Thrush	...	...	...	...	...	5
Other small birds	...	...	...	...	...	17
Frog	...	...	...	...	...	4
Cockchafer, remains	...	...	...	...	...	81
Dung and other Beetles, remains	...	...	...	...	...	53
						<hr/> 769 <hr/>

Apart from the common shrew mouse, the frog and the dung beetles, and certain of the birds, the destruction of this food is a distinct gain to the farmer. Moreover, in none of these pellets was any trace of game birds found.

We must have thousands of Barn-Owls in this country and it would not prove any great task to obtain many thousands of pellets.

* *Journ. N'amp'tn. N.H. Soc.*, 1913, p. 63.

The above mentioned 410 pellets contained of rats, mice and voles alone 395 specimens. Let us suppose that in 300 different localities two pellets were obtained daily for a year. On the basis of the above examination 219,000 pellets would account for the destruction of about 210,000 rats, mice and voles, and this is actually what is taking place all over the country. Yet it seems certain that the fact is not realised by farmers and others.

During the past eighteen months numerous complaints have been received stating that farm vermin have not been so plentiful for many years past. In some districts vermin have increased almost to the dimensions of a plague. The pecuniary loss to the farmer and to the nation generally can only be reckoned in millions of pounds sterling. Surely it is not too much to ask that the numerous agricultural societies and farmers' clubs should interest themselves in a matter so intimately related to their calling. Much also might be done in our rural schools to educate the rising generation on such matters.

In the interests of farmers and the community in general it is certainly high time that a species of wild bird of such great utility as the Barn-Owl should be most strictly preserved. In spite of statements to the contrary both the birds and their eggs are destroyed and this will continue until much more severe penalties are exacted.

* * * * * *

NOTES ON MANURES FOR JANUARY.

E. J. RUSSELL, D.Sc.,
Rothamsted Experimental Station.

Another Waste Lime.—In connection with the previous references in these notes to waste lime a correspondent sends the following particulars of a "dried waste mud" which he is able to obtain from a paper works. Its composition is:—

Moisture	...	...	...	...	11.9 per cent.
Calcium carbonate	..	...	...	...	83.3 " "
Free lime (CaO)	...	...	...	...	1.9 " "
Caustic soda (NaO ₂)	...	...	...	...	0.09 " "
Small stones and clinker	...	...	...	...	2.9 " "

He proposes to use it on rough pasture land in Derbyshire at the rate of 4 tons to the acre.

The sample is quite suitable for use and the rate of dressing is sound, but the value of the material would depend on the ease

with which it can be spread. If it were dry and in fine powder it would be worth about three-quarters the price of good ground limestone: it is not, however, in so good a condition. It has to be spaded out, but as the frost will cause it to disintegrate this is no drawback: at about one-quarter the price of ground limestone the material would be worth having.

A Northern Town Refuse.—The Superintendent of the Cleansing Department, Gateshead, sends the following particulars of the fertiliser made by the town authorities from the refuse. The tins, bottles, glass, and similar materials are removed: stable manure, slaughterhouse refuse and earth-closet material are added, and the whole passed through a preliminary machine and broken up to pass through a 5/8 grate. As 90 per cent. of the houses in Gateshead are of the old earth-closet type the house refuse contains a considerable proportion of human excrements: it is not surprising therefore that the manure finds a ready sale.

The material is delivered in 5-ton lots, and on a farm 5 miles away the price works out to 5s. 6d. per ton, the steam wagons taking the material where possible into the actual field which is to be treated. It has given good results on roots, and it improves the physical texture of the soil, though it still remains to be seen whether the material lasts as well as farmyard manure. On the farm in question farmyard manure is estimated to cost 14s. 2d. per ton.

It cannot be assumed, however, that all town refuse is as good as this. Towns on the water system have less valuable material to dispose of, and farmers should not buy until they know just what it is likely to be worth to them.

Green Manure.—In view of the necessity for increasing the supplies of organic matter in the soil, a correspondent in East Kent sends the following account of a method he has tried with advantage. He sowed red clover in a crop of wheat, but instead of letting it stand for hay he ploughed it in after harvest. On another part of the same field trefoil was similarly sown in the wheat and afterwards ploughed in. A third portion was seeded with rye grass, and the rest of the field was left in wheat only. After ploughing in the green crops oats were sown. Red clover and trefoil both produced a marked improvement in growth, as one would expect. It might be urged that this use of red clover would be prejudicial to the sowing intended for seeds hay as increasing the risk of clover sickness. This objection probably would not apply to trefoil, and as the seed is cheap the gain to the oat crop was a profitable one.

A method used with success on light land in the Lothians is to sow in the wheat in April $1\frac{1}{4}$ bushels Italian rye grass and 2 lb. red clover per acre. This mixture of seeds costs 11s., has made good growth at harvest and continues growing well afterwards. The crop is grazed until the end of January and then ploughed in for oats. As a heavy oat crop is desired this receives a top dressing of 1 cwt. of sulphate of ammonia per acre.

Basic Slag: should it be High Soluble or Low Soluble?—

In days before the War farmers were always urged to purchase only high soluble slag, and the grades sold by the best firms had a solubility of 80 per cent. and upwards. During the War the process of manufacture changed and it is an open secret that the experts are no longer so much in agreement as they were in regard to the desirability of a high soluble slag.

Experiments have been initiated to obtain more definite information, and until these are completed it is not possible to lay down precise rules for the farmers' guidance.

In the meantime it is wise to assume that a high soluble slag will usually come into action more quickly than one of low solubility, and that a larger return may therefore be expected in the first season. It is possible, however, that in later seasons the low soluble slag may grow in effectiveness, and at the expiration of five years there may be little difference between the two; in some experiments, *e.g.* in Essex, this is clearly demonstrated. Until more definite evidence is forthcoming perhaps the safest assumption the farmer can make is that high soluble slag may pay him interest on his outlay almost from the beginning, while the returns from low soluble slag may be deferred.

Use of Artificial Fertilisers for Barley.—An interesting experiment was made last season to ascertain the effect of fertilisers on barley when grown in the usual way in rotation. Many farmers do not give artificial manure to their barley for fear it should go down or suffer in malting quality. The risk of lodging is of course real, but it can be minimised by the use of a stiff strawed variety such as "Plumage Archer." In some cases barley responds to superphosphate, which causes no lodging, but in the writer's experience the fear of nitrogenous fertiliser is often unnecessary. The following trial was made on the Stackyard or Sheepcote Field at Rothamsted, the barley being grown in the ordinary way of cropping, and following wheat. The yields were :—

		<i>Grain per Acre :</i>		<i>Straw Weight of Corn</i>		<i>Grain to</i>
		<i>Head Corn.</i>	<i>Tail Corn.</i>	<i>per acre.</i>	<i>per bushel.</i>	<i>100 of straw.</i>
		bushels.	lb.	cwt.	lb.	
No manure	...	27.5	103	17.3	55.0	83.4
Superphosphate only						
(200 lb. per acre)	...	27.2	128	17.6	55.7	82.8
Superphosphate (200 lb. per						
acre) + Sulphate of Am-						
monia (112 lb. per acre)		37.4	160	24.2	55.5	82.6

The dressing of superphosphate and sulphate of ammonia has given an additional 10 bushels of head corn, $\frac{1}{2}$ cwt. of tail corn and 7 cwt. of straw over that yielded by the unmanured. The weight per bushel of corn was heavier also.

The Distribution of Manures over the Rotation.—In most field experiments the effect of the manure is tested on one crop only, no notice being taken of the remaining crops. In practice, however, these other crops are a serious consideration and farmers frequently ask how best to distribute their manures over the rotation.

There are still farmers who put all their manures on to one crop and apply nothing in the rest of the rotation. This is justifiable only in special cases, *e.g.* in early potato farming. In the early potato district on the Firth of Forth the potatoes alone receive manure and not the rye or rape that comes in between. In an ordinary four- or five-course rotation it is a mistake to confine the manure to one crop only, even when the aftermath of the "seeds" is fed off.

An interesting experiment on this subject has been going on for some years in the Back House Field at Cockle Park. The soil is light and the rotation is swedes, barley, hay, oats. Some of the best results were obtained by dung alone for swedes (10 tons per acre), followed by artificials alone for hay (1 cwt. sulphate of ammonia, 5 cwt. superphosphate, 1 cwt. muriate of potash per acre). Nothing better was obtained in any of the various ways of dividing up the manures.

At Cockle Park a dressing of phosphate so increases the clover in the seeds hay that no nitrogenous top dressing is necessary for the subsequent corn crop. In cases where this good development of clover is not obtained, however, the cereal crop would need a top dressing.

Use of Potassic Fertilisers for Potatoes.—During the current season some interesting results have been obtained at Rothamsted showing the effect of potassic fertilisers in a severe drought. It was found that potash had a marked effect in the absence of dung, but only little action in its presence. All the

yields were low, but they were somewhat above the county average of 3 tons per acre.

	<i>No artificial manure.</i>		<i>Superphosphate + sulphate of ammonia.</i>		<i>Potash + superphos- phate + sulphate of ammonia.</i>	
	tons	cwt.	tons	cwt.	tons	cwt.
No farmyard manure. ...	1	17	1	7	3	15
Farmyard manure added	3	7	3	13	3	16

Although all these crops involved a financial loss owing to the drought the dressing of potash in absence of farmyard manure makes a considerable difference in reducing the loss. The experiment indicates that wherever farmyard manure is running short a dressing of potash should be given.

No significant difference was revealed in these experiments between sulphate of potash and sylvinit or French kainit, but the season was not favourable for testing points of this nature.

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NOTES ON FEEDING STUFFS FOR JANUARY.

E. T. HALNAN, M.A., Dip. Agric. (Cantab.),
Ministry of Agriculture.

Feeding Potatoes to Live Stock.—In several districts potatoes have fallen to a price at which it pays the grower to feed them to live stock rather than sell them. Several correspondents have asked for information on feeding potatoes, and a few practical points are given here.

Horses.—With regard to horses potatoes may be fed either raw or cooked in amounts up to 17 lb. a day.

Cows and Fattening Bullocks.—With regard to cows or fattening bullocks, up to 28 lb. per head per day may be fed with safety. These amounts represent the maximum. If fed in excess of these quantities digestive disturbances arise.

Pigs.—In the case of pigs the main question that arises is whether the potatoes should be fed cooked or in a raw state. For breeding stock and store stock, potatoes may be fed raw with safety. Only in the case of small pigs is it necessary to cook potatoes before feeding.

The above remarks refer in all cases to potatoes of good quality. Care should always be taken to avoid the "greening" of potatoes, since green potatoes develop a bitter principle which makes them very distasteful to stock. In the case of

diseased and frosted potatoes steaming or cooking should be adopted if it is desired to feed them.

Maize Gluten Feed.—This fairly cheap nitrogenous feeding stuff is at present on the market, and several correspondents have asked for information as to its feeding value. Maize gluten feed consists of a mixture of the by-products obtained in the manufacture of maize starch and can be regarded as the maize grain with most of the starch removed. It is rich in oil and protein and is well suited for dairy and fattening stock. This feeding stuff has been included in the table in order that *Journal* readers may obtain some idea of its relative value for feeding.

The Mineral Requirements of Pigs.—Owing to the nature of their diet, pigs are very often fed on foods deficient in the ash constituents that are necessary if they are to remain in good health and grow satisfactorily. Such substances are roots and maize products. This deficiency will also occur where pigs are kept on the open-air system on light land farms. On American Agricultural Experimental Stations, much attention has been paid to the question of the mineral requirements of pigs, and experiments have been undertaken, particularly at the Iowa Experiment Station, under the direction of Professor Evvard. As the result of many experiments the following mixture has been suggested tentatively as a suitable complete mineral mixture for pigs :—

	<i>lb.</i>
Salt, common, flake form 	30·0
Spent bone black, or bone meal, finely ground or bone flour	25·0
Commercial kainit, or potassium chloride, or wood ashes ...	12·0
Sulphur, flowers of 	10·0
Air-slaked lime, or limestone, finely ground 	10·0
Glauber's salts or sodium sulphate 	5·7
Epsom salts or magnesium sulphate 	5·0
Copperas, or iron sulphate 	2·0
Potassium iodide 	0·3
	<hr/> 100·0 <hr/>

This mixture does not represent the final word on the subject, and the station is still engaged in putting experimental knowledge to practical test. Pig feeders, however, will probably find that the use of this mixture will help to condition their pigs and keep them in good growing condition. About 1 lb. per month per adult pig is the suggested allowance when hand-fed. For those who wish to have a fairly simple mineral

—	Price.		Price per Ton.	Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit. Starch Equiv.	Price per lb. Starch Equiv.
	s.	lb.	£ s.	£ s.	£ s.		s.	d.
Wheat, British - -	50/-	504	11 2	1 17	9 5	71.6	2/7	1.38
Barley, English Feeding	36/9	400	10 6	1 6	9 0	71	2/6	1.34
" Canadian - -	34/0	400	9 10	1 6	8 4	71	2/4	1.25
Oats, English White,,	32/9	336	10 18	1 9	9 9	59.5	3/2	1.70
" Black & Grey	30/-	336	10 0	1 9	8 11	59.5	2/10	1.52
" Argentine - -	28/-	320	9 16	1 9	8 7	59.5	2/10	1.52
Maize, " - -	36/-	480	8 8	1 5	7 3	81	1/9	0.94
" Gluten-feed - -	—	—	9 10	2 15	6 15	75.6	1 9	0.91
Rye, English - -	43/6	504	9 13	1 8	8 5	72	2/4	1.25
Millers' offals—Bran -	—	—	9 10	2 10	7 0	45	3/1	1.65
" Coarse middlings	—	—	11 10	2 10	9 0	64	2/10	1.52
Barley meal - -	—	—	13 0	1 6	11 14	71	3/1	1.78
Maize " - -	—	—	8 17	1 5	7 12	81	1/11	1.03
Fish " - -	—	—	16 10	7 12	8 18	53	3/4	1.78
Linseed - -	—	—	17 10	2 16	14 14	119	2/6	1.34
" Cake, English (9% oil)	—	—	14 5	3 12	10 13	74	2/11	1.56
Cottonseed,, English (5% oil)	—	—	9 17	3 5	6 12	42	3/2	1.70
" Egyptian (5% oil)	—	—	9 12	3 5	6 7	42	3/-	1.61
" decorticated (7% oil)	—	—	14 0*	5 6	8 14	71	2/5	1.29
Palm kernel cake (6% oil)	—	—	7 15*	2 1	5 14	75	1/6	0.80
Brewers' grains,dried,ale	—	—	10 2	2 7	7 15	49	3/2	1.70
" " "porter	—	—	9 0	2 7	6 13	49	2/9	1.47
" wet, ale	—	—	2 5	0 12	1 13	15	2/2	1.16
" wet,porter	—	—	1 18	0 12	1 6	15	1/9	0.94
Malt culms - -	—	—	7 5	3 6	3 19	43	1/10	0.98
FARM VALUES.								
	—	—	Value per Ton on Farm.	Manurial Value per Ton.	Food Value per Ton.	S.E. per 100 lbs.	Value per s.	Market Value per lb. S.E. d.
Potatoes - -	—	—	1 19	0 8	1 11	18	1/9	0.94
Swedes - -	—	—	0 17	0 5	0 12	7	1/9	0.94
Mangolds - -	—	—	0 17	0 6	0 11	6	1/9	0.94
Good Meadow Hay	—	—	6 12	1 14	4 18	31	3/2	1.70
Good Oat Straw -	—	—	3 11	0 17	2 14	17	3/2	1.70
Good Clover Hay	—	—	7 3	2 2	5 1	32	3/2	1.70
Vetch and Oat Silage	—	—	2 10	0 15	1 15	14	2/6	1.32

* Prices at Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of November and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton. Its manurial value is £2 1s. per ton. The food value per ton is therefore £7 19s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 1d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.11d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market.

mixture which supplies the main essential elements, equal parts by weight of air slaked-lime and salt, or of wood ashes and salt will prove suitable.

Mineral deficiency in pigs is generally shown by the pigs developing a "staring" coat and a tendency to go down at hindquarters. In severe cases the condition of complete paralysis may occur. The effects produced are very similar to those experiments when diets deficient in vitamins are fed.

A Simple Method of obtaining the Nutritive Ratio of Mixed Rations.—Correspondence in the agricultural papers recently suggests that feeders often have great difficulty in ascertaining the nutritive ratio of a mixed ration. The nutritive ratio of a ration shows the proportion existing between the digestible protein of a ration and the digestible non-protein substances. Thus, the nutritive ratio of 1 : 6 indicates one part of digestible protein to 6 parts carbohydrate equivalent.

From a table of composition of feeding stuffs giving the digestible protein and the nutritive ratio of the separate substances, it is quite easy to calculate the nutritive ratio of any mixed ration. The method is as follows:—Ascertain the amount of digestible protein present in each ingredient in the ration and multiply this by the nutritive ratio to get the carbohydrate equivalent. Do this for each ingredient in turn, add the digestible protein figures together and also the figures obtained by multiplying by the nutritive ratio, divide this second figure by the first and this will give the nutritive ratio of the ration. A concrete example will illustrate the method:—

<i>Ration.</i>	<i>Dig. Crude Protein.</i>	<i>Carbohydrate Equiv.</i>
4 lb. Linseed Cake ...	contains $(4 \times .253) = 1.01$ and $(1.01 \times 2) = 2.02$	
50 lb. Mangolds ...	„ $(50 \times .007) = .35$ „ $(.35 \times 13) = 4.55$	
10 lb. Meadow Hay	„ $(10 \times .054) = .54$ „ $(.54 \times 8) = 4.32$	
	<u>1.90</u>	<u>10.89</u>

$$\text{Nutritive Ratio of Ration} = \frac{10.89}{1.9} = 1 : 5.6$$

Any other ration may be worked out in a similar manner.

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COUNCIL OF AGRICULTURE FOR ENGLAND.

THE Seventh Meeting of the Council of Agriculture for England was held on 6th December last, at 2.30 p.m., at the Middlesex Guildhall, Westminster, S.W.1, Sir Douglas Newton, K.B.E., being unanimously elected to the Chair in the absence of Lord Selborne abroad. The Minister of Agriculture was present throughout the proceedings.

The question of the draft regulations for the Voluntary Registration of Bulls was considered. The scheme embodied in the regulations had been drawn up by the Live Stock Advisory Committee of the Ministry and arose out of a reference which the Council had made to that Committee of a resolution which had been proposed at its Meeting of 4th March last by Sir Merrik Burrell. Sir Merrik Burrell suggested an amendment of Clause 1, which was not accepted by the Council, and after further discussion, in which the Minister took part, it was agreed that the draft regulations should be referred back to the Agricultural Advisory Committee.

Lt.-Col. H. E. Disbrowe-Wise moved :—

“That the Council recommend the Ministry to promote legislation on the lines of Section 10 of the Corn Production Act, 1917, recently repealed, with the object of enabling the Agricultural Committees to deal with the rabbit pest in cases where damage to crops is sustained by the attacks of vermin from adjoining occupations.”

The mover said that it had been argued that the tenant farmer had the remedy in his own hands, as he could kill or trap or net rabbits. He could not, however, enter anyone's land in order to destroy them. Colonel Disbrowe-Wise thought that difficulty usually arose when the owner of the rabbits was a shooting-tenant and not the owner of the land. Cases of this sort could generally be managed with a little diplomacy, but where that was not possible, the tenant had no remedy at law. He asked, therefore, that Section 10 of the Corn Production Act, 1917, should be re-enacted.

Lord Bledisloe, in seconding the resolution, said that strenuous efforts had been made to get the Section re-enacted in the last Agriculture Act, but without success. The grievance may not be a very real one at the present, but he was afraid it was likely to develop. There was the danger from shooting-tenants, who were often townspeople having no interest

whatever in farming and who allowed rabbits to increase unduly. He would strongly deprecate legislation which would allow a tenant farmer to enter woods abutting his farm in order to destroy rabbits, but it ought to be possible with the help of Agricultural Committees to frame regulations which would prevent such persons as he had described from being a real danger to farming property.

Mr. McCracken thought Railway Companies were great offenders and Mr. Donaldson supported the motion as one who had suffered from the depredations of the vermin. Mr. Acland said that in cases in Devonshire and Somerset which he knew, it was the landlord who was trying to put the rabbits down and the farmer who was trying to keep them up. He found that the increase of rabbits on his own property had enormously added to the expense of planting trees on account of the wire netting required. He thought the resolution a good one and deplored the fact that farmers frequently preferred sixpennyworth of sport to £6 of damage done by rabbits.

The Minister said that he fully realised the great damage done by rabbits and vermin. If the Council passed this resolution, the only way it could be carried out would be by legislation. He would be quite prepared, so far as he was concerned, to see that the legislation was introduced, but it would have to be quite clear that any money required to make it effective could not be found by the Treasury. A Rabbits Officer would appear to be required. He would ask the Council how the legislation would be carried out. The Cultivations Committee used to have a considerable staff of officers, but nearly all that staff had been disbanded. They did not want to see such an Act as was proposed become a dead letter, and it could only be prevented from becoming so by the expenditure of money. Would those who now supported this proposal also support in their respective Local Councils the expenditure of sufficient money to carry out the provisions of an Act?

Mr. Bruford suggested that the members of Agricultural Committees could deal with the matter voluntarily, or that the County Land Agents could take it in the course of their ordinary work. He did not think the County Councils would object to expending the small amount of money required. Mr. C. P. Hall and Mr. Hawk considered that means could be taken by which the cost would become negligible. Mr. Colin Campbell agreed with this view and Major Courthope, M.P., suggested that the jurisdiction of Petty Sessional Courts might be used without the appointing of any additional officers. He thought that the

resolution should refer to damage sustained on plantations as well as crops. Sir Merrik Burrell considered that any expense should be borne by the man who was responsible for the nuisance. Mr. Gardner suggested that the onus of clearing out rabbits should be placed upon occupiers and the County Councils given sufficient power to take legal action against offenders and have them fined.

It was then moved and seconded that the words "and plantations" should be inserted after the word "crops." This was agreed to and the motion was carried.

Mr. German inquired as to whether any payment would be made to small farmers in regard to fractions of acres which had not so far been allowed in the claims made by them in respect of their crops of wheat and oats during the past season. The Minister replied that the matter had been placed before the Law Officers of the Crown, who had advised that it would be illegal to pay on fractions of an acre and that no regulation which he could make could possibly give payment any validity. In the case where a man had several fields and his crops ran out to a fraction of an acre on each field, then the various fractions would be added together and paid for as acres, but it would be illegal to pay on the ultimate fraction. It was a hardship on the small man who grew less than an acre, but he had no other course open to him than to accept the Law Officers' decision. It was purely a legal question and unfortunately had not been raised while the original Act or the repeal Act was in passage through the House, or it might have been provided for in advance. The matter could not now be remedied by legislation which could not now be passed before Easter next at the earliest, when it would be impossible to check any claims that were sent in.

Mr. German suggested that the Law Officers had not stated that hedges and ditches should not be paid for and that it might be open for the Minister to include an allowance for these and so bring up the fraction to a whole acre. The Minister stated, however, that the legal view was that the area of hedges and ditches should be deducted as they form no part of the acreage of the crops.

Mr. Acland, speaking on the point of the matter not having been raised during the passage of the Bills, said that must have been because it could never have occurred to anybody that fractions of acres would not be paid for. It seemed to him to be one of the most amazing legal decisions he had ever heard and

he thought it should be put right by legislation. In his view it was an entirely illegal and absurd injustice to the small man and he believed that there ought to be enough money over or money voted by Parliament to enable these fractions to be paid for.

Mr. McCracken moved :—

“That in the opinion of this Council it is desirable that a carefully considered record should be prepared, so as to be available for reference in any future emergency, of the policy pursued in relation to Agriculture during the Great War; and that in order to prepare such record full investigation should be made, by such means as the Ministry in their wisdom think best, now, while the facts and circumstances are fresh in the memories of those most conversant with them, into :—

(1) The efficacy or otherwise of the various Orders made in securing the results desired.

(2) The administration and effect of those orders.

(3) Improvements in policy and procedure which careful consideration and experience gained may suggest.”

He suggested that the carrying out of the motion would not involve any considerable expenditure. In any case it was essential that the inquiry should be conducted on anti-waste principles. The result should be historic in character. He instanced one or two cases of unfortunate policies which had been adopted during the War in which the existence of a careful record might prevent their recurrence at any future time. Mr. Colin Campbell seconded the motion, saying that he hoped the occasion would never arise in which to use the experience proposed to be recorded.

The Minister of Agriculture said that he was generally in sympathy with the objects of Mr. McCracken's motion and, as a matter of fact, considerable steps had already been taken to carry out what was proposed. Records had already been published in the Reports of the War Cabinet for the year 1917-1918 and in the proceedings of the Food Production Department. Sir Thomas Middleton, who had been principal officer of the Food Production Department, was publishing a book on Food Production as one of a series to be entitled “The Economic and Social History of the World War” to be issued by the Carnegie Trust. He suggested that the Council should await the publication of this book before asking the Ministry to take further steps. The motion was then put to the Meeting and carried.

Lord Strachie moved :—

“That it is desirable that a full report of all Meetings of the Council and of the Agricultural Advisory Committee should appear in the *Journal* of the Ministry of Agriculture.”

The mover said that the reports of the meetings held in August and October covered hardly more than a page and a half in *The Journal of the Ministry of Agriculture*. There had also been an omission, the letter which the Minister had written to the chairman, Lord Selborne, which contained a reference to the embargo on store cattle, not having been printed in the *Journal*, and agriculturists had, therefore, not had an opportunity of seeing it. No increased cost in the publication of the *Journal* would appear to be necessary inasmuch as other matters could be, without much loss, left out of the publication. The terms of his resolution were not mandatory in any sense; all he wished was that the Council should express an opinion, leaving it to the better judgment of the Minister whether he thought it desirable to act on the suggestion. Mr. Colin Campbell seconded the motion.

The Minister said that he was quite prepared to agree to the publication of fuller reports of the Council's meetings in the *Journal* of the Ministry. He did not think that Lord Strachie meant that they should be inserted verbatim. If they were, they would fill the *Journal* to the exclusion of a great deal of most valuable matter. As to reports of the proceedings of the Agricultural Advisory Committee, that was, more or less, a confidential body which acted in the manner of a Cabinet, and it would be undesirable to publish its proceedings in detail. He thought, however, that the reports summarising its conclusions, one of which was now about to be submitted to the Council, should be printed in the *Journal*.

The motion was then put to the Meeting and carried.

Mr. E. W. Langford moved that the report of the Agricultural Advisory Committee should be received by the Council. (This Report is printed on p. 942 of this *Journal*.)

The Minister announced that in conformity with a suggestion which he had made in a letter to Lord Selborne on 4th October, 1921, a copy of which had been circulated to each member of the Council, he was prepared to make a statement to the Council at each of its statutory meetings which would cover a general review of the situation with regard to agriculture during the preceding six months. On the proposal of Mr. Donaldson, seconded by Mr. Colin Campbell, the offer was warmly welcomed by the Council and agreed to.

SECOND REPORT OF THE AGRICULTURAL ADVISORY COMMITTEE FOR ENGLAND AND WALES.

SINCE 11th August last the Agricultural Advisory Committee has met twice, viz., on 12th October and 9th November, the following subjects having been dealt with at the meetings :—

(1) **Wart Disease of Potatoes.**—A Memorandum setting out the position with regard to this disease was considered, and it was decided that the planting of non-immune varieties of potatoes be allowed in areas scheduled as Infected Areas under the Wart Disease Order, though no such varieties are to be planted on land actually known to be infected with the disease. Additional restrictions are to be placed upon the movement of potatoes as follows :—(1) Potatoes of susceptible varieties which have been grown in any infected area so declared by the Ministry, the Board of Agriculture for Scotland, or the Department of Agriculture for Ireland, are not to be moved into any clean area; (2) If disease appears in any crop grown in England and Wales, the potatoes shall not be marketed except in a place mentioned in a licence granted by the Ministry; (3) Potatoes for planting shall not be sold anywhere in England and Wales unless the grower of them has obtained a certificate from the Ministry or from the Scottish Board, or the Irish Department, to the effect (a) that the potatoes are of an approved immune variety, true to type, and free from rogues, or (b) that the potatoes have not been grown in any infected area, and that Wart Disease has not been reported to have occurred on the holding on which the potatoes were grown.

(2) **The Allocation in England and Wales of the Proposed Grant of £850,000 for Promoting Agricultural Development.**—

A Memorandum covering and explaining the proposed general lines of the allocation was considered, and a Sub-Committee was appointed to go into the details of the matter with the Ministry and to report again to the Committee. This Sub-committee has not yet presented its Report.

(3) **Telephone Facilities at Railway Goods Stations.**—The Council of Agriculture for England had at its meeting on 27th May, 1921, passed the following resolution :—

“ That in the opinion of this Council, all railway goods stations at which perishable produce is dispatched or received should be connected with the public telephone forthwith.”

The Ministry had been furnished with a list of certain stations in important fruit and vegetable growing districts, and had written to the Ministry of Transport with regard to the resolution citing the cases of the particular stations named. The Ministry of Transport replied that it had taken up the matter with the Railway Company whose stations were named and that they had answered that whilst they realised that such telephones if fitted would serve a useful purpose they were not essential and that the Company were unable to take any further action in the matter.

The Committee considered that this reply was unsatisfactory, and that the question was one of general application and not confined to the particular Railway Company which had sent this reply. In view of the fact that the lack of telephones resulted in trucks not being available when required for urgent transport of perishable fruit and vegetables, and that markets were frequently missed and other losses incurred, the value of which would many times exceed the cost of the installation and maintenance of telephones, the Committee considered that some special steps should be taken. It was decided that the case should, in the first place, be brought by the Controller of Horticulture before an early meeting of the Interdepartmental Committee on Transport so that its observations may be available at the next meeting of the Agricultural Advisory Committee.

(4) **The Provision of Land Drainage Work for Unemployed.**—The Minister outlined this scheme in aid of which an allocation of £650,000 of the money which the Government had decided should be spent in the relief of unemployment, had been obtained for agricultural drainage work. Advances were to be made through Drainage Authorities and County Agricultural Committees, on condition that ex-Service men mainly were employed and that at least 35 per cent. of the money advanced be refunded to the State when the work was completed. The Minister had been unable to lay the matter before the Committee prior to the publication of the scheme as the work was urgent. Some 30 schemes had already been initiated in various parts of the country, and as soon as they were formally approved they would commence.* No unnecessary formalities would be allowed to stand in the way of work under the scheme being at once started. The scheme was formally approved by the Committee.

* See also p. 922.

(5) **Report of the Royal Commission on the Importation of Store Cattle.**—The Minister opened a discussion upon this subject, though he said that he would not ask the Committee for their final views until they had had an opportunity of consulting the Minutes of Evidence which were not yet published. After some expression of views by the members of the Committee, the discussion was adjourned, pending publication of the evidence, and in view of the special meeting of the Council of Agriculture for England on 22nd November (see this *Journal*, December, 1921, p. 772).

(6) **Committee on Credit Facilities for Farmers.**—In accordance with the Resolution passed in the following terms by the Council of Agriculture for England at its meeting on 4th October, 1921 :—

“ That in view of the sudden and drastic alteration made by the Government in their agricultural policy, they are hereby respectfully requested to make provision for advances on loan, in approved cases of working capital, to farmers who have recently purchased their holdings, on similar lines to those followed in the case of small-holders, and that the Agricultural Advisory Committee should be asked to appoint a Special Committee of members of this Council to consider whether a sound system of credit can be devised for submission to the Government,”

a Preliminary Committee was set up by the Advisory Committee to consider the personnel of the Special Committee and its terms of reference. This Preliminary Committee recommended that the Special Committee should consist of Sir Douglas Newton, Mr. E. W. Langford, Mr. John Roberts, Mr. G. G. Rea, and Mr. W. R. Smith, M.P., members of the Council, with the addition of Mr. R. Holland Martin, Secretary of the Bankers' Clearing House, and Sir Anker Simmons, Auctioneer and Estate Agent, as co-opted members; and that its terms of reference should be :—

“ To consider and report whether in the interests of maintaining production, and to promote employment on the land, it is desirable to revive or to extend the scheme of providing short term credit for farmers which was in operation during the War.”

The Preliminary Committee stated that it had carefully considered the scheme referred to in the suggested reference and was of opinion that a scheme on similar lines would probably meet the needs of the present case, and that any such scheme should be limited to the supply of working capital.

(7) **Exportation of Artificial Fertilisers.**—It was suggested on behalf of the Ministry that the restrictions on the exportation of artificial fertilisers, which were the result of special conditions created by the War, should be finally removed. An Order in Council under the Fertilisers (Temporary Control of Export) Act, 1920, prohibited the export of sulphate of ammonia, superphosphate, basic slag, and compound manures containing any of them, except by licence of the Board of Trade. An open general licence had already been issued authorising export of sulphate of ammonia. The position in regard to superphosphate and basic slag was carefully considered, and it was decided that the position should be reviewed again at the next meeting.

(8) **Landing of Hay and Straw from France.**—The French Government had requested the British Government to permit once more the landing of hay and straw from France. The prohibition had begun in 1908 and all hay and straw (except that actually used as packing for merchandise, or manufactured straw not intended for use as fodder or litter, or hay and straw permitted to be imported by licence for use afterwards as fodder and litter for animals) was prohibited unless it came from Australia, Canada, South Africa, New Zealand, U.S.A., Norway, Channel Islands, and the Isle of Man. The Committee considered the matter and agreed that some further enquiries should be made as to the restrictions which France enforced against the produce of this country.

(9) **R.S.P.C.A. proposed Bill to order the Slaughter of Horses Rejected as Unfit for Export.**—The details of this proposal were considered at the meeting, and it was decided that the present powers of the Ministry under the Exportation of Horses Act, 1914, were sufficient to meet the needs of the case, and that it be recommended that the Minister's approval of the proposed Bill be withheld.

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CONCILIATION COMMITTEES IN AGRICULTURE.

THE total number of Conciliation Committees which have been established under the Corn Production Acts (Repeal) Act, 1921, has now increased to 57; of these 39 have made agreements as to wages. In certain cases some of these agreements have temporarily lapsed, though meetings are being held with a view to making agreements for a further period. Details of the agreements in operation at the end of last month were published in the December issue of this *Journal*, and particulars of further agreements since arrived at are given below:—

<i>Area.</i>	<i>Period.</i>	<i>Wages.</i>	<i>Hours per week.</i>
Essex -	Up to 31st Dec., 1921	9d. per hour on weekdays. 1s. per hour on Sundays.	—
Hampshire -	„ 14th Jan., 1922	36s. 0d.	48
Lancashire:—			
Southern Area	„ 31st Dec., 1921	45s. 0d.	Usual working hours.
Northern „ -	„ 31st „ „	47s. 6d.	„ „
Eastern „ -	„ 31st „ „	50s. 0d.	60
Leicester:—			
Melton Mowbray and District	„ 31st „ „	36s. 6d.	50
Middlesex:—			
South-West	„ 28th Jan., 1922	9½d. per hour on weekdays. 1s. per hour on Sundays.	50, with guaranteed week of 48 hours.
Nottinghamshire	„ 31st Dec., 1921	38s. 0d.	50
Rutlandshire -	„ 31st Jan., 1922	34s. 0d.	48
Monmouthshire -	„ 31st Dec., 1921	38s. 0d.	48
Cardiganshire -	„ 28th Feb., 1922	36s. 0d.	50
Glamorgan -	„ 31st Dec., 1921	40s. 0d.	50
Merioneth -		35s. 0d.	50
and			
Montgomery -	„ 31st Jan., 1921	38s. 0d.	56

The rates in the majority of cases apply to “adult male workers,” the Committees apparently relying on Clauses 11 (a) and (b) of the Act to cover the special cases of workers who are affected by some mental or physical disability. In a few areas the Committees have stipulated that the rates shall apply only to workers of “fair average ability,” while in two cases a further clause has been inserted providing that the recommended rates should affect only those workers of the classes mentioned “who are regularly employed in agriculture.”

In the majority of instances the Committees have confined their recommendations to adult male workers, and have not so far dealt with the question of wages for workers under 21, which for the time being are left to be settled by mutual agreement between worker and employer. In the following areas, however, the Committees have agreed on rates for juvenile male workers:—Cornwall, Cumberland and Westmorland, Devon, Durham, Isle of Ely, Hertfordshire, Kent, Leicester—Bosworth Ashby, Melton Mowbray, Market Harborough, Northamptonshire, Nottinghamshire, Soke of Peterborough, Shropshire, Somerset, Warwick, Yorkshire—North and East Ridings, while in the following areas rates have been agreed on for certain classes of female workers:—Cumberland and Westmorland, Devon, Durham, Hertfordshire, Kent, Nottinghamshire, Yorkshire—East Riding. It should be mentioned that in several of these areas the agreements having been made for comparatively short periods have now lapsed.

The principle of fixing valuations for the provision of “allowances” made by employers to workers as part payment of wages has been adopted by certain of the Conciliation Committees. In Wales where the “living in” practice widely applies the Committees seem especially to favour this course and have in almost every case fixed a value for board and lodging. A cottage valuation has also been adopted by several Committees.

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It frequently happens that landowners who desire to redeem the tithe rentcharge charged on their properties experience considerable difficulty in ascertaining the exact

**Redemption of
Tithe Rentcharge:
Search Charges.**

amount of the tithe rentcharge to which their lands are legally liable. In some cases the statutory parish copies of the tithe apportionment and map have been damaged or lost. In other instances the property in respect of which redemption is desired may extend into a number of different parishes, townships, hamlets or tithings, for each of which there is a separate tithe apportionment and map, so that the landowner who obtains, locally, particulars of the tithe rentcharge on his property, may be put to the trouble and expense of searching documents deposited at a number of different places in the custody of a number of different people.

With a view to assisting in such cases, the Ministry (3, St. James's Square, London, S.W.1) has made arrangements for supplying details of the tithe rentcharge charged on any property on being furnished with a plan, preferably on a $\frac{1}{2500}$ scale Ordnance Sheet, with the existing boundaries of the property clearly and accurately defined thereon by an edging of colour. For this service a uniform search charge will be made amounting to 5s. if the property does not exceed 10 acres, 10s. if it exceeds 10 acres but does not exceed 30 acres, and a further 5s. for every additional 30 acres or part of 30 acres, irrespective of whether one or more tithe apportionments and tithe maps may have to be consulted. For example, the cost of supplying details of the tithe rentcharge on 300 acres of land will be 10s. plus nine times 5s., that is, £2 15s.

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The Value of Whey in Feeding Pigs.—Experiments have been carried out recently at Reading University College Farm to determine the value of whey in feeding pigs, and it has been demonstrated that pigs fed on whey and whey constituents, and having access to grass, will thrive to a much greater degree than those kept under the usual sty conditions and fed on swill, etc., both in regard to appearance and quality of their flesh. These experiments suggest that whey contains an insufficiency of fat-soluble vitamin A. to allow excess for storage in the fat, and that grass or green food makes up for the deficiency.

Pig-Feeding

Experiments.

Results show that young pigs fed on grass and toppings for a period of 84 days increased on the average 49 lb. in live weight, whereas similar pigs fed with whey, grass and toppings for the same period made an average live weight increase of 72 lb.

These experiments tend generally to substantiate what has for a long time past been the opinion of cheesemakers throughout the country—namely, that very considerable advantage can be gained by the feeding of whey to pigs.

Pigs and the Fat-Soluble Factor.—Another experiment at Reading University College Farm has recently been carried out with the object of ascertaining the influence of the fat-soluble factor on the growth of pigs. Four animals were employed, divided into two groups. Group 1 was placed on a diet containing the fat-soluble factor, and Group 2 was kept on a diet rigorously restricted in that factor. The test was carried out over a period of five months, and further experiments are in progress.

The results so far obtained are as follows :—

(1) No definite rickets were induced in sucking pigs fed from birth on a diet rigorously restricted in the fat-soluble factor.

(2) The addition of the fat-soluble factor in the form of cream, cod-liver oil and lucerne to a deficient diet stimulated growth in pigs declining in weight.

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In the House of Lords on 3rd November last, Lord Strachie raised the question of the need for crop reports, and asked what was the number of crop reporters, and what was the cost of crop reporting during the past financial year compared with the last financial year before the War. In dealing with the whole question the Earl of Ancaster, Parliamentary Secretary of the Ministry of Agriculture and Fisheries, replied as follows :—

**Crop Reporting,
and the Collection
of Agricultural
Statistics.**

The answer to the noble Lord's Question asking for these particulars is that the number of crop reporters in the year 1913-14 was 220, and in 1920-21, 336. The amount voted for crop reporting in the earlier year was £3,600, and the actual cost £3,137; in 1920-21 the amount voted was £36,500 and the actual cost was £34,117. The increase in the cost since 1913-14 was mainly due to the fact that in the earlier period the Annual Agricultural Returns were collected by the Customs and Excise. The actual cost of the work to the Customs and Excise in 1913-14 is not known. It was all taken as a block Vote, and the only information we can give on that point is that about thirty years earlier the annual cost was estimated at £11,800; but since 1890 no special provision has been made in the Vote for the work done by the Customs or Inland Revenue under this head, as it has been lumped in with other services. There has been, however, no material change in the character of the work between 1913-14 and 1920-21, and although it is probable that it is more efficiently done under the present system, it may be taken as certain that the collection of the Annual Returns is not more costly than if they were still being collected by the Customs.

The transfer from the Customs was made in consequence of the increased duties placed upon that Department in other directions, and was authorised by the Treasury in 1919, the work relating to these Annual Returns being undertaken from that time by part time officers of the Ministry, known as crop reporters. That is to say, crop reporters, after that time, had to furnish the Annual Agricultural Returns which, up to that time, had been furnished by the Customs. These officers, who received in the aggregate £3,600 in 1913-14 and £5,325 in 1915-16, when other duties were cast upon them, were considered to be underpaid. I think they were complaining that they did not receive enough money, and when this additional work was placed upon them, their remuneration was increased, partly in respect of the new work, and partly in respect of their previous duties.

These persons who, as I have said, number 336, are usually land agents, land valuers, or other persons possessing a knowledge of agriculture in the districts with which they deal. They are paid by fees averaging about £100 per annum, but varying according to the size of the district allotted to them. When the heavy work previously done by the Customs was taken over in 1919, it was considered that this work could only be done efficiently by creating smaller districts than those which had hitherto been used for the Ministry's crop reporting; hence the number of reporters was increased from 220 to 336. The work consists of:—(a) The collection annually of a Return of the area under crops and the number of live stock on holdings of more than one acre; (b) the estimation of the production of the principal crops; and (c) the supply to the Ministry of a monthly report on the condition of crops and agricultural conditions generally. In addition the crop reporters supply special information as required.

The value of these Returns cannot be questioned. They are the basis of all discussions on agricultural policy, and afford the only real measure of the dimensions of the industry, the changes in cultivation, the number of live stock, the yield of crops, and other questions of primary importance from an economic point of view. I may say that this question has been carefully gone into by the Ministry, and I think it is very doubtful indeed if any possible economy can be made in this direction, if the information that is now obtained is still desired. Of course, it is a question of policy, and perhaps a very proper question for the Agricultural Council, or some body like that, to state whether these Returns and crop reports need be so full. There is now, as the noble Lord knows, a monthly crop report, but I may say that the Department have examined it very closely, and that it is certainly the general opinion of the Ministry that these reports should be as full and the statistics as careful and as well-informed as they now are. I am afraid it is very doubtful indeed, in fact impossible, that the expenditure upon them can be cut down to any large extent.

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AGRICULTURE ABROAD.

LIVE STOCK IN ARGENTINA—DAIRY PRODUCE IN CANADA.

THE annual Live Stock Exhibition organised by the Argentine Rural Society took place at Buenos Aires in September. As in

**Live Stock
Exhibition
in Argentina.**

previous years, the awards were made by judges specially invited from the United Kingdom.

Shorthorns were again the chief feature of the Exhibition both in the high standard of the exhibits and in the number of entries. The Hereford classes, which have done so much towards the success of the cattle-raising industry in the Argentine, were well represented. A distinctive feature was the display of Aberdeen-Angus cattle, which received much favourable comment; the growth of this breed in Argentina during the past few years has been remarkable both in numbers and in quality. In view of the great advance which the dairying industry is making in the Argentine, considerably more interest was shown at this year's Exhibition in dairy cattle.

There were some exceptionally good specimens of the various breeds of sheep and pigs. Although the expansion of the motor industry has been detrimental to horse-raising generally, some good specimens of the Shire and Clydesdale classes were exhibited. The French breeds were well represented, as also were Hackneys and other light breeds, but the reduction in entries reflects the diminished interest in carriage horses.

The sales of exhibits were disappointing to exhibitors on account of the low prices realised, which were 40 per cent. below those of last year's Exhibition. This fall in prices is attributed to unfavourable conditions in the Argentine; there has been a serious drought, resulting in a scarcity of pasture and a general fall in the prices of cattle.

In opening the Exhibition the Argentine Minister of Agriculture referred to the effects of the War on the stock-breeding industry, and emphasised the futility of expecting to maintain in times of peace the inflated prices which ruled during the War. He maintained that future prosperity lay in high quality, and urged the value of good selection in the purchase of breeding stock.

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THE importance of grading dairy produce for sale has for some time been clearly realised in Canada, where a system of grading has been carried out under both Federal and Provincial authorities, as well as by other bodies, both official and unofficial. The object of this grading has in some cases been mainly educational, while in others the aim has been purely commercial, but the system hitherto has been conducted on a voluntary basis and has had no legislative authority behind it.

**The Grading
of Dairy Produce
in Canada.**

During the 1920 session of the Canadian Parliament, a resolution calling upon the Government to establish a grading system was introduced into their House of Commons. The unanimous support of the members was accorded, and the Minister of Agriculture, in accepting the principle of the resolution, said that he would be prepared to carry out a scheme of grading for dairy produce as soon as the producers were ready for the introduction of such a system.

It would appear that the dairy producers must have afforded speedy evidence of their desire for Government action in this matter, for an Act, "to regulate the grading of dairy produce," cited as the Dairy Produce Act, was passed by the Canadian Legislature on 4th June, 1921. The Act empowers the Governor in Council to make regulations for the grading of dairy produce intended for export, the articles enumerated being "butter, cheese and other food products manufactured from milk." It also provides for the appointment of official graders, and for the establishment of standards, definitions, grades and grading stores for dairy produce and the imposition of fees for the grading. The graders are to be empowered to issue certificates as to the quality and proper classification of any dairy produce which they have examined for the purpose. Fines of from 50 to 200 dollars, or imprisonment for a term not exceeding 3 months, may be imposed for contraventions of the regulations issued under the Act.

The value of the Act in promoting the standardisation of Canadian dairy produce intended for export and in discouraging the production of an inferior article can hardly be over-estimated, and it would be well if the importance of this progressive step could be clearly brought home to every British dairy farmer.

AGRICULTURAL RETURNS, 1921.

PRODUCE OF POTATO AND ROOT CROPS IN ENGLAND AND WALES.

PRELIMINARY STATEMENT showing the Estimated Total Produce and Yield per Acre of the POTATO and ROOT CROPS in England and Wales in the Year 1921, with Comparisons for 1920, and the Average Yield per Acre of the Ten Years 1911-1920.

—	Crops.	Estimated Total Produce.		Acreage.		Average Estimated Yield per Acre.		Average of the Ten Years 1911-20.
		1921.	1920.	1921.	1920.	1921.	1920.	
ENGLAND AND WALES.	Potatoes ..	<i>Tons.</i> 2,958,000	<i>Tons.</i> 3,151,000	<i>Acres.</i> 557,800	<i>Acres.</i> 544,615	<i>Tons.</i> 5·3	<i>Tons.</i> 5·8	<i>Tons.</i> 6·1
	Turnips and ..	6,611,000	14,193,000	893,423	988,451	7·4	14·4	12·4
	Swedes ..							
	Mangold ..	6,284,000	7,307,000	373,722	384,278	16·8	19·0	18·7
ENGLAND.	Potatoes ..	2,812,000	3,053,000	531,648	516,983	5·3	5·9	6·2
	Turnips and ..	5,982,000	13,484,000	843,428	932,829	7·1	14·5	12·3
	Swedes ..							
	Mangold ..	6,110,000	7,166,000	363,366	373,699	16·8	19·2	18·7
WALES.	Potatoes ..	146,000	98,000	26,152	27,682	5·6	3·5	5·4
	Turnips and ..	629,000	709,000	49,995	55,622	12·6	12·8	14·5
	Swedes ..							
	Mangold ..	174,000	141,000	10,356	10,579	16·8	13·3	17·1

Potatoes were planted in good time and under favourable conditions, but in many parts of the country the young plants were damaged by late frosts, which occurred even as late as June in some parts, and were especially severe in the Cambridgeshire district, where the crops never recovered from the damage thus inflicted. The prolonged drought also checked growth and the yields on light land were very poor. Sprouting became very prevalent during August. The total production in England and Wales is estimated at 2,958,000 tons, which is some 200,000 tons less than in 1920, but nearly 230,000 tons greater than in 1919. The comparatively large production, which is greater than in any year previous to 1917, is due to the increased area under crop, as the yield per acre—5·3 tons—is about 16 cwt. per acre under average, and 10 cwt. per acre less than the poor crop of last year. Smaller yields per acre have been recorded three times only in the last 35 years. The reduction in yield per acre was most marked in the eastern counties, several counties averaging less than 3 tons per acre. The yields were under average in nearly all parts of England, though over average in most counties in Wales. The yield is estimated at 6 tons per acre in Lincolnshire and over 7 tons per acre in Lancashire.

It has proved very difficult this year to estimate the yields of turnips and swedes, as large but unknown areas of land returned as being intended for sowing with these crops were not sown at all owing to the drought, or were sown very late, with the result that the plants have made very little growth, and the yield of roots is consequently very doubtful. In addition, large areas which were sown failed entirely and were ploughed up. Many crops

which were sown early and promised fairly satisfactory yields were severely attacked by mildew, and the roots are consequently of little use. The estimates of the turnip and swede crop are, therefore, much less reliable than usual. The yield per acre is estimated at 7·4 tons, which is 5 tons under average, and the smallest yield on record. Crops are very light in the eastern, south-eastern, and midland counties, but in the south-west, in the north, and in Wales yields are not so bad, though still well under average. The only counties in which the yields are better than usual are Cumberland and Westmorland, where 18 tons and 17 tons respectively have been obtained. The total production is estimated at 6,600,000 tons, which is 7,600,000 tons less than last year, and 5,700,000 tons below the average of the 10 years.

Mangolds did better than turnips and swedes, but these were checked in growth by the drought, and the roots are generally smaller than usual. Early sown crops were a fairly satisfactory plant, but the later sown germinated unevenly and were generally thin and patchy. The total production is estimated at 6,280,000 tons, or about 1,000,000 tons less than in 1920, but only 10,000 tons less than in 1919. The yield per acre—16·8 tons—is nearly 2 tons below average, but nearly a ton greater than in 1919. Yields were very light in the eastern and south-eastern counties, but most of the northern counties obtained crops which were rather better than usual, while in the midlands yields were only about 1 ton per acre below average.

The very small quantity of roots grown,* combined with the very light hay crops, makes the outlook for the winter feeding of stock far from promising, though the position is more favourable in the north and west (including Wales) than in other parts of the country.

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Foot-and-Mouth-Disease.—*Kent*: The existence of Foot-and-Mouth Disease on premises at Under River, near Sevenoaks, was confirmed on 24th November in seventeen heifers. These animals together with 109 breeding ewes, with which they had been pastured, were slaughtered. This outbreak followed an interval of three-and-a-half months during which Great Britain had been free from the disease. There has been no further development either in Kent or any other part of Great Britain.

The usual restrictions were imposed on 24th November over an area of 15 miles radius from the infected premises, but the satisfactory position has permitted a considerable modification of these restrictions. It is anticipated that the remaining general restrictions will be entirely withdrawn by the end of 1921, if the present position is unchanged.

Leaflets issued by the Ministry.—Since the date of the list given on page 857 of the December issue of the *Journal*, the following leaflets have been revised :—

No. 111.—Co-operative Selling of Eggs.

„ 249.—“Couch” or “Twitch.”

„ 331.—The Canning of Fruit and Vegetables.

„ 344.—Compound Manures.

Withdrawn leaflets reissued :—

F.P. 41.—The Making of Fruit Pulp, now Leaflet 380.

* See this *Journal* for November, 1921, p. 725.

QUESTIONS IN PARLIAMENT.

Imported Eggs.—Mr. Pretyma asked the Minister of Agriculture whether he will take steps, and if necessary, introduce legislation, to cause foreign imported eggs to be stamped with the name of the country of origin, and so prevent the injury now suffered by both producers and consumers in this country where imported eggs are sold as new-laid British?

Major Barnston (Comptroller of the Household): I have been asked to reply. I understand that the Board of Trade proposes to introduce legislation to give effect to the principal recommendations contained in the report of the Merchandise Marks Committee (Cd. 760 of 1920) with regard to the marking of foreign goods, which include eggs. (November 2, 1921.)

Ecclesiastical Tithe Rent-charge (Rates) Act.—Mr. Pretyma asked the Minister of Agriculture whether the present interpretation of the Ecclesiastical Tithe Rent-charge (Rates) Act, that where an incumbent holds two or more benefices in plurality each benefice must be treated as separate for the purposes of the Act, is in accordance with the intentions of the Government in framing the Act; and, if not, will he introduce a short amending Bill early next session to rectify the error?

Major Barnston: I am advised that the interpretation of Section 1 (2) of the Act, as indicated in the question, although correct, does not represent the intention of the Government when framing the Act, and the question of the practicability of submitting to the House an amendment of the Act is under consideration. (November 2, 1921.)

Summer Time.—Lieut.-Colonel Pownall (by private notice) asked the Secretary of State for the Home Department whether any agreement has yet been come to with the French Government for making the period of summer time commence and terminate on the same date in the two countries?

The Secretary of State for the Home Department (Mr. Shortt): A Conference has recently been held with representatives of the French and Belgian Governments, and an agreement was reached that the summer time period should commence on the night of the last Saturday in March, or the last Saturday but one in March when the last Saturday is the day preceding Easter Day, and end on the night of the first Saturday in October. The Government have carefully considered this proposal, and in view of the serious inconvenience at present caused by the difference between the three countries in the dates of commencing and ending summer time, they have approved the proposal, which corresponds very nearly to the dates which have been fixed in this country, and have informed the French Government that they are prepared to submit to Parliament legislation to give effect to it. It is the intention of the Government to introduce a Bill for this purpose early next Session. I should add that the summer time period in France at present commences on 15th March and ends on 25th October, so that the French Government have made very large concessions in their desire to meet us. December 15, 1921.)

Unfit Horses (Export).—In reply to a question by Mr. A. Herbert regarding the export of horses, Sir Arthur G. Boscawen (Minister of Agriculture) stated that the Ministry's policy is, in substance, so to administer the Exportation of Horses Acts as to ensure that worn-out or decrepit horses,

namely, horses unfit for work, shall under no circumstances be passed for shipment, and that every practicable step shall be taken to secure the comfort of all animals during the passage. For this purpose a very high standard of fitness to travel and to work is insisted upon, and a great improvement has been effected in the fittings of the vessels used for the trade. I understand that maltreatment of horses is already punishable under French and Belgian law, which I have no doubt the authorities do their best to enforce. (November 7, 1921.)

Potatoes from Germany.—In reply to a question by Lord Bledisloe regarding a rumour which, he said, was current in all our chief potato-growing districts, that large quantities of potatoes raised in Germany are being imported, or are about to be imported, into this country through various neutral countries, the Earl of Ancaster stated that the importation of potatoes from the Netherlands and other countries adjacent to Germany in the present year is quite normal, and gives no ground for suspicion that fictitious re-consignment of German potatoes from an intermediate country is being attempted. There is a payment of 26 per cent. under the German Reparation (Recovery) Act, and I understand that the Customs officers have standing instructions to watch importations which might cause suspicion to arise that endeavours are being made to avoid, by fictitious re-consignment from an intermediate country, the payment of this 26 per cent.

Under the Safeguarding of Industries Act, 33½ per cent. is charged in certain cases. The first part of that Act does not apply to potatoes; neither does Part II. From enquiries which have been made by the Ministry of Agriculture, I understand that the trade in Continental potatoes is bad. In the few cases where trade is being done the quality is moderate. The Ministry is satisfied that the quantities which are being imported are not an important factor in determining the price of home-grown potatoes. (November 8, 1921.)

Home-Grown Sugar, Limited.—Lieut.-Colonel Willey asked the Minister of Agriculture if the Government have a nominee on the board of Home-grown Sugar, Limited; whether the price now being offered for next year's beet is believed to be substantially below cost of production unless wages are further substantially reduced; and if, in view of the large amount of employment afforded by this industry, he is considering the removal of Excise on home-grown sugar?

Sir Arthur G. Boscawen: The answer to the first part of the question is in the affirmative. At the prevailing rates for wages and transport it is possible that the proposed minimum guaranteed price for next year's beet is below the present cost of production, but in addition to benefiting by any decrease in costs of production, the farmer will share equally with the company in any profits derived from an increase of sugar content above 16 per cent. and of sugar price above £43 per ton duty paid. As regards the last part of the question, home-grown sugar is already receiving favourable treatment, the Standard Excise duty being 19s. 5½d. per cwt., as compared with 25s. 8d. on foreign sugar and 21s. 4½d. on colonial sugar. (November 10, 1921).

NOTICES OF BOOKS.

An Abstract of the Legislation in force in the British Empire, dealing with Plant Pests and Diseases up to the year 1920.—(*E. Marguerite Ralfs, B.A.* London: Imperial Bureau of Entomology, 1921.) As indicated by the title, this is a brief summary of the various orders respecting fungus diseases and insect pests, chiefly in relation to their importation into the various countries with which it deals. It should prove of value not only to the student of economic entomology and plant pathology, but also to the exporter of plants who has hitherto had to rely largely on the information contained in the post office guide, the original orders not being generally available in this country. In some cases particulars are given of the measures in operation for dealing with pests already established. In the case of England and Wales, however, the silver leaf, wart disease, onion smut and American gooseberry mildew orders have been dismissed very briefly. Owing to the frequent changes in phytopathological legislation, the abstract is soon likely to become out of date, and it is hoped that timely revision may be found possible—as a compendium of this kind should fill an undoubted need. If arrangements could be made to include also abstracts of the legislation of foreign countries as well as those within the British Empire, the publication would be even more valuable, and its appearance annually would be fully justified.

Report on a Simple Steam Sterilizer.—(*W. A. Hoy and R. Stenhouse Williams.* London: Dairy Supply Co., Ltd.) From tests made recently at the National Institute for Research in Dairying, University College, Reading, of a simple steam sterilizer designed for use on dairy farms where no other source of steam is available, it appears that if effective sterilization is to be obtained within a reasonable time, it must be carried out under certain fixed conditions, namely—

- (1) The source of heat must be such that steam at 210°F issues from the outlet pipe within a limited time. In these experiments, in which the largest vessel to be steamed was a 17-gallon milk churn, satisfactory results were not obtained until the source of heat, when applied to one gallon of water at 60°F., was sufficiently great to produce steam at 210°F. at the outlet pipe within ten minutes of its first application.
- (2) The source of heat must maintain its intensity throughout the steaming.
- (3) All milk utensils, including milk churns, should be covered while being steamed.
- (4) The steaming should be carried out in a place free from draughts.
- (5) An accurate thermometer is essential.

The initial temperature of the room does not appear to affect the operation appreciably. Successful results were obtained when the temperature of the room and of the utensils was as low as 40°F. before steaming commenced.

Conditions conducive to ineffective steaming.—(1) The experiments showed that where an uncovered churn was being steamed and the windows were opened, a fall in the recorded temperatures took place which was further accentuated by the draught caused.

(2) It was shown that efficient steaming, within a reasonable time, was dependent on steam in sufficient volume and at a sufficiently high temperature being produced within a time limit.

The apparatus used in the experiments referred to in the report consisted of an ordinary boiling pan (with steam jet) heated by means of two No. 1 "Primus" Stoves, Roarer Pattern.

SELECTED CONTENTS OF PERIODICALS.

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- Agriculture as a Business, *L. Smith Gordon*. (Better Business, Nov., 1920.) [334(04); 338.1.]
- The Agriculture Act, 1920, *C. B. Marshall*. (Jour. Farmers' Club, April, 1921.) [347(e).]
- Intensive Cultivation, *Prof. F. Keeble*. (Rept. Brit. Assoc., 1920, Sect. M.) [63.191.]
- How Explosives help to develop Waste Land, *A. W. Wilson*. (Agr. Eng., Vol. 2, No. 6, 1921.) [63.12; 63.196.]
- Forecasting the Crops from the Weather, *R. H. Hooker*. (Quart. Jour. Roy. Meteor. Soc., Vol. xlvii, No. 198, April, 1921.)
[A review of the subject of correlation of weather and crops with references.] [551.5.]
- The Weather and Cyclical Fluctuations, *W. W. Bryant*. (Econ. Jour., March, 1921.) [551.5.]
- Hosten af Roefro i 1920 og Roefrohandelen i Vinteren 1920-1921, *E. Lindhard* and *J. C. Lunden*. (Tidsskrift for Planteavl, 27 Bind, 5 Hæfte, 1921.) [63.1951; 63.198.]
- Les Micro-organismes du Sol dans leurs rapports avec la Croissance des Plantes: Position actuelle du Problème, *E. J. Russell*. (Ann. Sci. Agron., 38, No. 2, 1921.) [63.115.]
- The Nature of Soil Acidity with regard to its Quantitative Determination, *W. H. MacIntire*. (Jour. Amer. Soc. Agron., Vol. 13, No. 4, 1921.) [63.113.]
- A Contribution to the Investigation into the Results of Partial Sterilisation of the Soil by Heat, *Viscount Elveden*. (Jour. Agr. Sci., Vol. xi, Pt. 2, 1921.) [63.115.]
- Effect of Soil Temperature upon the Development of Nodules on the Roots of Certain Legumes, *F. R. Jones* and *W. B. Tisdale*. (Jour. Agr. Res., Vol. 22, No. 1, 1921.) [63.32; 576.83.]
- Relation of Potassium to Growth in Plants, *T. O. Smith* and *O. Butler*. (Ann. Bot., Vol. xxxv, No. 188, April, 1921.) [63.161.]
- The Influence of Fertilisers containing Borax on the Yield of Potatoes and Corn—Season 1920, *A. W. Blair* and *B. E. Brown*. (Soil Science, Vol. xi, No. 5, 1921.) [63.161.]
- The Effect of Organic Nitrogenous Compounds on the Nitrate-Forming Organism, *E. B. Fred* and *A. Davenport*. (Soil Science, Vol. xi, No. 5, 1921.) [576.83.]
- Emploi de CO₂ comme Engrais atmosphérique, *R. Cerighelli*. (Ann. Sci. Agron., 38, No. 2, 1921.) [63.168.]
- Increasing the Efficiency of Crude Calcium Cyanamide, *M. Popp*. (Deuts. Landw. Presse, 1920, p. 617 and Bied. Zentr., 50 (1921), pp. 216-220.) [63.167.]
- Über die Düngewirkung der Kohlensäure, *A. Gehring*. (Fühl. Landw. Ztg., Jahrg. 70, Heft 7/8, 1921.) [63.168.]
- Experiments with "Radio" Manure. The Effect of Coaldust on Crops.
[A fertiliser composed of phosphate, burnt lime and coaldust, and claimed to be radio-active.] (N.Z. Jour. Agric., Vol. xxii, No. 3, 1921, p. 162.) [63.169.]
- Finely Ground Raw Phosphate—Notes and Opinions on its use in Agriculture, *A. F. Ellis*. (N.Z. Jour. of Agric., Vol. xxii, No. 6, 1921.) [63.1672.]
- The Phosphate Industry, *W. Packard*. Part I.—Sources of Supply of Mineral Phosphate. Part II.—Superphosphates. (Jour. Soc. Chem. Ind., Vol. 40 (1921), No. 15, p. 288; No. 16, p. 304.) [63.1672.]
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- A Comparison of Magnesians and Nonmagnesian Limestones, *A. W. Blair*. (Jour. Am. Soc. Agron., Vol. 13, No. 5, May, 1921.) [63.168.]

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- Colloid Problems in Bread-Making, *R. Whympere*. (Rept. Brit. Assoc., 1920, Appendix, p. 61.) [664.6.]
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- Sur l'Agriculture polonaise, *M. Jean Dybowski*. (Compt. Rend. Acad. Agr., No. 24, 1921.) [63(4).]
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- Root Development in Barley and Wheat under Different Conditions of Growth, *W. E. Brenchley* and *V. G. Jackson*. (Ann. Bot., Vol. 35, No. 140, Oct., 1921.) [63.311(04); 63.313.]
- The Development of the Flower and Grain of Barley, *W. E. Brenchley*. (Jour. Inst. Brewing, Vol. 26, pp. 615-632.) [63.313.]
- A Comparative Study of the Composition of the Sunflower and Corn Plants at Different Stages of Growth, *R. H. Shaw* and *P. A. Wright*. (Jour. Agric. Res., Vol. xx, No. 10, 1921.) [63.33(d); 612.394.]
- Nettles as a Forage Crop, *W. E. Brenchley*. (Modern Farming, May, 1921.) [63.33 (d).]
- Spartina Problems, *Prof. F. W. Oliver*. (Ann. App. Biol., Vol. vii, No. 1, 1920.) [58.2; 63.33(d).]
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- Tobacco Growing in Ireland: The Experiments in 1920 (with a list of previous articles), *G. N. Keller*. (Jour. Dept. Agr. &c., Ireland, Vol. xxi, No. 2, 1921, p. 200.) [63.3461(04).]
- Essais de sorgho et maïs à sucre en vue de la production de l'alcool industriel effectués dans les Pyrénées-Orientales en 1917, *J. Ruby*. (Ann. Sc. Agron., 37th year, No. 2, May-July, 1920.) [63.349.]
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- The Industrial Utilisation of the Potato, *A. E. Harris*. (Jour. Roy. Agr. Soc. Eng., Vol. 81, 1920.) [63.344; 63.512(04).]
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- Root Development in Newly Planted Trees, *B. T. P. Barker*. (Agr. and Hort. Res. Sta., Long Ashton. Ann. Rept., 1920.) [63.41(04).]

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- The Sources of Infection of Potato Tubers with the Blight Fungus, *Phytophthora infestans*, *Paul A. Murphy*. (Sc. Proc., Roy. Dublin Soc., Vol. 16 (N.S.), No. 29, Aug., 1921.) [63.24.]
- Award of the Boyle Medal to Geo. H. Pethybridge, B.Sc., Ph.D. (with a brief report of his investigations of potato blight—*Phytophthora infestans*—and other work, and a list of papers published by him.) (Sci. Proc. Roy. Dub. Soc., Vol. xvi (N.S.), No. 20, 1921.) [63.24.]
- Lightning Injury to Potato and Cabbage, *C. R. Orton*. (Phytopathology, Vol. xi, No. 2, Feb., 1921.) [63.21.]

- Leafroll, Net-Necrosis, and Spindling-Sprout of the Irish Potato, *E. S. Schultz* and *D. Folsom* (Jour. Agric. Res., Vol. xxi, No. 1, 1921.) [63.24-33.]
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- Genetics of Rust Resistance in Crosses of Varieties of *Triticum vulgare* with Varieties of *T. durum* and *T. Dicoccum*, *H. K. Hayes*, *J. H. Parker* and *C. Kurtzweil*. (Jour. Agric. Res., Vol. xix, No. 11, 1920.) [575.1.]
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- Sunflower Silage Digestion Experiment with Cattle and Sheep, *R. E. Neidig*, *R. S. Snyder* and *C. W. Hickman*. (Jour. Agric. Res., Vol. xx, No. 11, 1921.) [612.394; 63.604(a).]
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- Notes on Breeding for Increase of Milk in Dairy Cattle (with 8 Pedigree Charts), *E. Robertson*. (Jour. Genet., Vol. xi, No. 1, 1921.) [575.4.]
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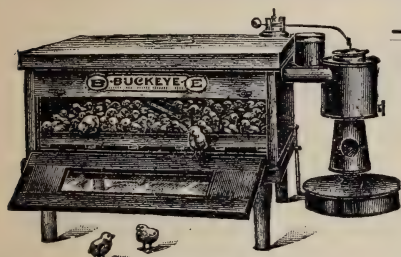


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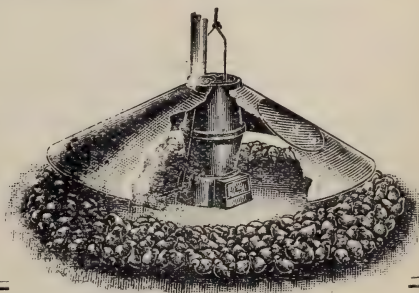
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HOW I MAKE BIG MONEY OUT OF UNMANAGEABLE HORSES.

By J. A. BUTLER.

ABOUT two years ago, when I was in America, I witnessed up in New York State an exhibition of horse-training that opened my eyes. A man by the name of Mackley took a devil of a mean, vicious mare that hadn't been harnessed for seven months, and in a few days had her gentle enough for a schoolgirl to drive. Mackley had taken the mare off the owner's hands for £10, and just ten days after sold her for £35. A clear profit of £25 in ten days!

That started me investigating. I learned that Mackley had simply used the methods introduced by the famous horse trainer, Jesse Beery. Beery, I learned, used to go about the country giving wonderful exhibitions in colt-breaking and horse-training; but realising that he could accomplish more by teaching his methods by post, had given up his exhibition work to spread his horse-training secrets by postal instruction. Mackley had studied Beery's Course in his spare time, and in a few months was able to accomplish magical results with unbroken colts and horses with bad habits.

OTHER SUCCESSES.

Mackley's work showed me a way to make some big money, and I determined to take Prof. Beery's Course in horse-training—but before doing so I made further inquiries. Here are what a few of Beery's students said. I'll let them tell of their success in their own words.

Mr. S. L. Arrant writes:—Just to test Beery's methods, I bought the worst balky, kicking, fighting horse I could find. Paid £13 for him. After handling him only a few hours according to Beery's system I sold him for £27.

Mr. Dell Nicholson, Portland, writes:—I have trained a four-year-old mare that was given up by everybody. Bought her for £7, and now have her so gentle, my little boy handles her. Wouldn't take £40 for her.

Dean L. Smith, Findley, writes:—By following Beery's instructions have changed a worthless, dangerous balker into a horse worth £45.

Everett McBlock writes:—Have just broken a pony to drive and taught it some tricks. Owner bought it for £3 10s. Paid me £8 to train it. He just sold it to a show company for £30.

HOW I WORK.

The big source of my income is in buying up unmanageable colts and horses at bargain prices, and, after training the animals, selling them at a

good profit. However, I also pick up good money handling colts and training horses for others on a fee basis. For instance, a farmer had a beautiful driving bay that had the bad habit of shying. A piece of paper blowing across the road would set the horse crazy. The owner thought a great deal of the animal, but couldn't take chances on the shying habit. A friend of his for whom I had done some work put this man in touch with me, and in a few hours I had the horse completely cured of the habit—for which job I received £10.

CURING BAD HABITS.

You can see from this that my work consists not only in breaking colts and "gentling" vicious horses, but in curing the various bad habits a horse can have—such as shying, balking, fear of motor-cars, etc., pulling at hitching strap, pawing in the stall, etc., etc.—Beery's methods of colt breaking are particularly amazing. Under the old way of handling raw colts one usually had to half kill the horse as well as himself to accomplish anything—and then the colt was usually spoiled or hurt in some way or another. But when you apply Beery's principles there is no hard, long work or injury to the colt.

No one should have a biting, kicking, or balky horse when it is so easy to cure these vicious habits. No one should attempt to break in a colt the old-fashioned way when Beery's methods make the task so easy. To every horse-owner, to every lover of horseflesh, my advice is to get acquainted with the Beery principles. You can not only make money for yourself, but you can do a world of good, particularly at this day when war-demands have placed a premium on horses.

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I have been requested to state that Prof. Jesse Beery will send his remarkable booklet, "How to Break and Train Horses," free to those interested. It is a booklet well worth having, as it reveals some startling information on horse-training. I have heard men who considered themselves expert horsemen say that the booklet was a revelation to them. There is no use in my going into details on the booklet when you can get it free for the asking.

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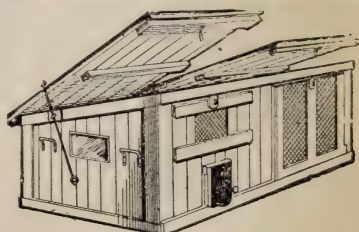
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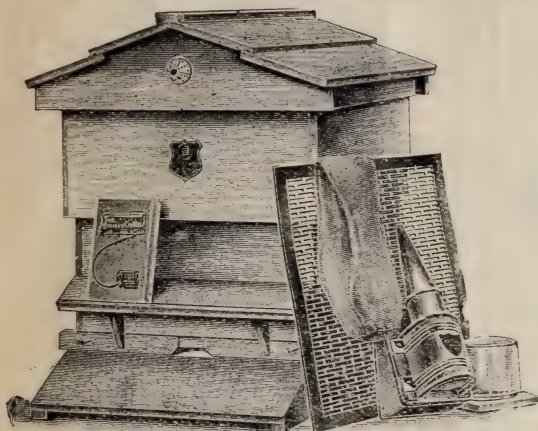
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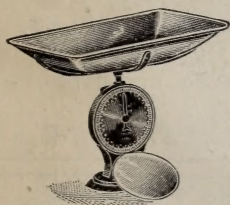
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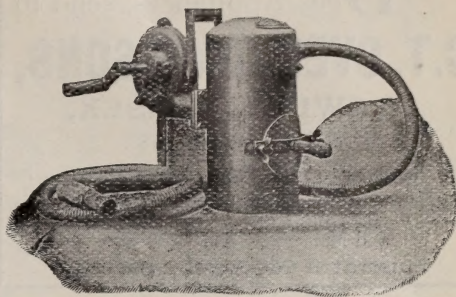
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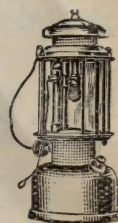
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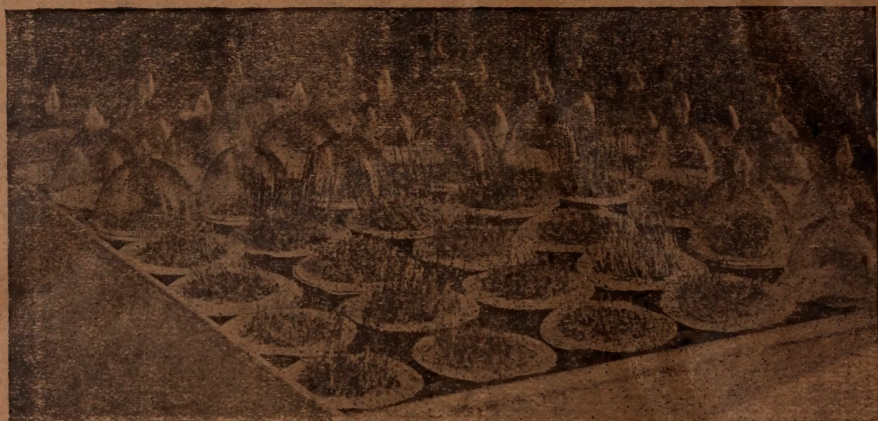
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